



CHEMICAL HYGIENE PLAN

DREXEL UNIVERSITY

JANUARY 2008

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In the event of a life threatening emergency dial 9- 911 for the emergency operator and contact Drexel security.

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DREXEL UNIVERSITY - CHEMICAL HYGIENE PLAN (CHP)

FOREWORD/DISCLAIMER

The Occupational Safety and Health Administration (OSHA) promulgated a final rule on January 31, 1990 for occupational exposure to hazardous chemicals in laboratories (The Lab Standard – 29CFR1910.1450). The basis for this standard is that laboratories typically differ from industrial operations in their use and handling of hazardous chemicals and that a different approach from the Hazard Communication Standard of 1987 is warranted.

The final OSHA standard, commonly known as the "Chemical Hygiene Plan for Laboratories," applies to all laboratories that use hazardous chemicals in accordance with the definition of laboratory use and laboratory scale as provided in the OSHA standard.

The effective date of the OSHA standard is May 1, 1990 and all Chemical Hygiene Plans (CHP) are required to be in place by January 31, 1991 in accordance with 29 CFR Part 1910.1450 of the *Federal Register*.

In compliance therewith, Drexel University has developed a Chemical Hygiene Plan, as described herein, and made effective this date.

Drexel University reserves the right to change, amend, add or delete any part or the whole of this plan at any time. Although the information in this plan is compiled from sources believed to be reliable, its accuracy is not guaranteed, nor is any responsibility assumed or implied for any damage or loss resulting from inaccuracies or omissions.

Any questions pertaining to the contents of this plan should be discussed with persons indicated in the Plan.

A. FORMAL POLICY STATEMENT

Drexel University is committed to providing a safe working environment and believes employees have a right to know about health hazards associated with their work. This Chemical Hygiene Plan introduces policies, procedures and responsibilities designed to develop in employees an awareness of potentially hazardous chemicals in the work place as well as the need to maintain appropriate and safe working areas and conditions. It is designed to assist employees in making knowledgeable decisions about any personal risks associated with employment at this institution.

Every Drexel student and employee is responsible for following the safety rules of Drexel University by reading and understanding the regulations and procedures contained within this document. All students and employees will have access to pertinent safety information through their supervisor who should be the first individual to contact for information or problems. In this regard, the following procedure should be followed:

Teaching Laboratories

1. Discuss the problem with your Teaching Assistant.
2. If not satisfied, discuss the problem with the Faculty member in charge of the laboratory.
3. If still not satisfied and the problem is that of ...
 - a. a chemical or physical hazard (other than radiation or laser) discuss the problem with the University Chemical Hygiene Officer.
 - b. a radiation or laser hazard discuss the problem with the Radiation Safety Officer.
 - c. a biological hazard discuss the problem with the University Biosafety Officer.
4. If still unsatisfied, request a meeting with the appropriate Safety Officer, the Faculty Member/Laboratory Supervisor and your Department Head.
5. If still not satisfied, request for a meeting with the Dean of the College.
6. If still not satisfied, request for a meeting with the University Provost.

Research Laboratories

1. Discuss the problem with your immediate supervisor.
2. If you are not satisfied, then discuss the problem with the Principal Investigator
3. If still not satisfied and the problem is that of...

- a. a chemical or physical hazard (other than radiation or laser) discuss the problem with the University Chemical Hygiene Officer.
 - b. a radiation or laser hazard discuss the problem with the Radiation Safety Officer.
 - c. a biological hazard discuss the problem with the University Biosafety Officer.
6. If still unsatisfied, request a meeting with the appropriate Safety Officer, the Principal Investigator and your Department Chair.
 7. If still not satisfied, request for a meeting with the Associate Vice President for Research Compliance

Drexel conducts an orientation program for new employees whether part time or temporary about the hazards of the work place and procedures to follow to avoid accidents. Additional site-specific training is available and may be necessary to fully educate employees on the hazards associated with different work practices, protocols and procedures. These training events may be presented by any of the appropriate University Safety Officers, the PI or the Department Head. In any event, however, training activities must be properly documented and copies of all syllabi and sign-in sheets must be sent to the University Safety Office.

For the purposes of this CHP, the term "supervisor" applies to that individual with the authority to assign, direct and review the work of one or more subordinates. This definition applies to laboratory, office or department heads and may, in some instances, apply to certain individuals who have supervisory functions under a laboratory, office or department head.

B. MSDS GLOSSARY

The following is a list of acronyms, terms, and definitions associated with the Material Safety Data Sheet of the Chemical Hygiene Plan.

Absorption	--	The process by which a substance can be readily taken into a body. For example, some chemicals can be absorbed through unbroken skin.
Acid	--	A compound consisting of hydrogen plus one or more other elements and which, in the presence of some solvents or water, reacts to release ions. Acids have the ability to turn litmus paper red and to neutralize bases.
Acute	--	Severe, usually critical, often dangerous conditions in which relatively rapid changes occur as a result of exposure to high concentrations of material over a short period of time. Acute effects are easier to reverse than are the effects of chronic exposure. See "chronic."

Alkali	--	A compound which has the ability to neutralize an acid and form a salt. Alkalis turn litmus paper blue. See "base and pH."
Aliphatic	--	Pertains to an open-chain carbon compound that is usually applied to petroleum products derived from paraffin base, has a straight or branched chain, and has a saturated or unsaturated molecular structure. Examples: hexane, naphtha, and mineral spirits.
Analgesia	--	Loss of sensitivity to pain.
Anaphylaxis	--	Hypersensitivity resulting from sensitization following prior contact with a chemical or protein.
Anesthesia	--	Loss of sensation or feeling.
Anhydrous	--	Does not contain water.
Anosmia	--	Loss of the sense of smell.
Anorexia	--	Loss of appetite.
Aqueous	--	A water-based solution.
Argyna	--	Local or generalized impregnation (gray-blue color) of the body tissues with silver.
Aromatic	--	Fragrant or of marked odor. Applied to a group of hydrocarbons and their derivatives characterized by the presence of one or more six-carbon rings. Examples are: benzene, toluene, xylene.
Asphyxia	--	Unconsciousness due to interference with the oxygen of the blood.
Asphyxiation	--	A condition that causes asphyxia, suffocation.
Asthma	--	A disease characterized by recurring attacks of dyspnea, wheezing, and cough, due to spasmodic contraction of the bronchioles.
Ataxia	--	A loss of power of muscular coordination.

Auto-Ignition Temperature--		the lowest temperature at which a flammable-gas or vapor-air mixture will ignite from its own heat source or a contacted heated surface without the presence of a spark or flame.
Barrier Cream	--	A cream for use on human skin to protect against injury from contact with specific types of harmful agents.
Base	--	A compound which reacts with an acid to form a salt. It turns litmus paper blue.
Biohazard	--	This is a combination of the words biological hazard and is used to describe infectious agents presenting a risk or potential risk to the well-being of man or animals either directly through infection, or indirectly through disruption of the environment.
Biological Half-Life	--	The time required for a given species, organ, or tissue to eliminate half of a substance which it takes in
Normal Boiling Point	--	The temperature at which a substance will boil. This is the point at which the vapor pressure of a liquid is equal to atmospheric pressure.
Bradycardia	--	A slow heartbeat in which the pulse rate falls below 60.
Breathing Zone	--	The area of the ambient environment in which a person breathes.
Bronchitis	--	Inflammation of the bronchial tubes in the lungs.
Buffer	--	Substance that reduces the change in hydrogen ion concentration in a solution, which otherwise would result from adding acids or bases.
Carcinogen	--	Any substance which, under certain quantified exposures, produces cancer in animals or humans. A chemical is considered to be a carcinogen if: (a) it has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen; or (b) it is listed as a carcinogen or potential carcinogen in the annual report on carcinogens published by the National Toxicology Program (NTP); or (c) it is regulated by OSHA as a carcinogen.
Ceiling Limit	--	A concentration that is not to be exceeded.

Carcinogenic	--	Cancer-producing.
Carcinoma	--	A malignant tumor or cancer; a new growth made up of epithelial cells, tending to infiltrate and give rise to metastasis.
Catalyst	--	A substance which, without changing its composition, causes a chemical reaction to occur.
Cataract	--	A loss of transparency of the crystalline lens of the eye or of its capsule.
Caustic	--	Something which strongly irritates, burns or destroys living tissue.
Chemical	--	Any element, compound or mixture of elements and/or compounds.
Chemical Name	--	The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which would clearly identify the chemical for the purpose of conducting a hazard <i>evaluation</i> .
Chemical Compound	--	A substance composed of definite proportions by weight of two or more elements, and whose properties differ from those of its elements. Also see "mixture."
Chemical Family	--	A group of individual elements or compounds with a common general name. Example: acetone, methyl ethyl ketone (MEK).
Chloracne	--	An acne-like eruption from contact with chlorinated naphthalenes and polyphenyls acting on sweat glands.
Chronic	--	Persistent, prolonged, and/or repeated effects, which are the result of repeated exposure to low concentrations of a chemical substance over a long period of time. See "acute. "
Chronic Effect	--	An adverse effect on a human or an animal with symptoms that develop slowly over an extended period of time or that recurs frequently.
Chronic Toxicity	--	An adverse effect resulting from repeated doses or

exposure to a substance over a relatively prolonged period of time. The term is usually used to denote effects in experimental animals.

- Combustible Liquid -- Any liquid with a flashpoint at or above 100° F. Combustible liquids are divided into two classes as follows: Class II liquids include those with flashpoints at or above 100° F and below 140° F, except any liquid having components with flashpoints of 200° F or higher, the volume of which make up 99% or more of the total volume of the mixture.
- Class III liquids include those with flashpoints at or above 140° F. Class III liquids are divided into two subclasses: Class III liquids include those with flashpoints at or above 140° F and below 200° F, except any mixture having components with flashpoints of 200° F, or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
- Class IIIB liquids include those with flashpoints at or above 200° F.
- Compressed Gas -- A gas under pressure of at least 40 pounds per square inch (psi) and some liquids with very high vapor pressure, i.e., pressure that exceeds 40 psi. Examples are argon, helium, and nitrogen.
- Concentration -- The amount of a substance uniformly dispersed in a given amount of fluid.
- Conjunctivitis -- Inflammation of the conjunctiva, the delicate membrane that lines the eyelids and covers the eyeballs.
- Contact Dermatitis -- Caused by contact with a primary irritant, a skin irritation at the area of skin contact.
- Cornea -- Transparent structure of the external layer of the eyeball.
- Corrosive -- Any material, liquid or solid, that causes visible destruction of, or irreversible alterations in human skin tissues at the site of contact (burns). See also Caustic
- Cutaneous Hazards -- Chemicals which irritate the skin.
- Cyanosis -- Blueness of the skin, generally caused by lack of oxygen.

Dermal	--	Pertaining to the skin.
Dermal Toxicity	--	Adverse effects resulting from exposure of the skin to a substance; ordinarily used to denote effects in experimental animals.
Dermatitis	--	Inflammation of the skin. There are two types of skin reaction: primary irritation dermatitis and sensitization dermatitis. Also see irritant, sensitizer, and contact dermatitis.
Dose	--	The term used to express the amount of energy or substance absorbed in a unit volume of an organ or individual. Dose rate is the dose delivered per unit of time.
Dysfunction	--	Any abnormality or impairment of an organ.
Dyspnea	--	Labored or difficult breathing; shortness of breath.
Eczema	--	A skin disease or disorder; one specific type of dermatitis.
Edema	--	An abnormal accumulation of clear, watery fluid in the tissues; swelling.
Element	--	A substance composed entirely of one kind of atom. Elements are designated by chemical symbols.
Emphysema	--	A lung disease in which the presence of air in the connective tissues of the lungs causes swelling or inflammation.
Epistaxis	--	Nosebleed; hemorrhage from the nose.
Evaporation Rate	--	The inverse of the time it takes a given amount of material to completely vaporize (evaporate) when compared to an equal amount of reference material.
Flammable Aerosol	--	An aerosol that yields a flame projection longer than 18 inches of full valve opening or a flashback (a flame extending back to the valve) at any valve opening.
Flammable Gas	--	A gas that will burn or explode if combined with air over a wide concentration range. Examples are acetylene, hydrogen, and propane.

- Flammable Liquid -- A liquid that has a flashpoint below 100° F (38 C) and can be ignited by a spark without any pre-heating. Examples are acetone, toluene, and methanol.
- Flammable Solid -- A solid, other than a blasting agent or explosive, that is ignited easily and burns intensely without any other fuel being needed. Ignition can occur through friction, absorption of moisture, spontaneous chemical change, or retained from manufacturing or processing. Examples are aluminum and titanium powders.
- Flammable (Explosive)-- Indicates the explosive or flammable range of a vapor or gas. Those concentrations of a vapor or gas in air below or above which flame does not occur on contact with a source of ignition. The-lower explosive limit (LEL) is the minimum concentration below which the vapor-air mixture is too lean to burn or explode. The upper explosive limit (UEL) is the maximum concentration above which the vapor-air mixture is too rich to burn or explode. LEL and UEL are given in terms of percentage by volume of gas or vapor in air.

Limits - LEL & UEL

	Concentration is	
Concentration is	referred to as	Concentration is
referred to as	Explosive or	too
rich to	flammable range	explode
too lean to explode	LEL	UEL
100% air	100% air	100% air

- Flash point -- The lowest temperature at which liquid produces enough vapors to form an ignitable mixture with the air.
- Fume Fever -- An acute condition caused by a brief high exposure to the freshly generated fumes of metals, such as lead or magnesium, or their oxides.
- Gastroenteritis -- Inflammation of the stomach and intestines.

Hazardous Material	--	A material that is characterized by one or more of the following: (1) has a flashpoint below 140° F, closed cup, or is subject to spontaneous heating; (2) has a threshold limit value below 500 ppm for gases and vapors, below 500 mg/m ³ for fumes, and below 25 mppcf for dusts; (3) single oral dose LD ₅₀ or below 50 mg/kg of body weight; (4) is subject to polymerization which results in the release of large amounts of energy; (5) is a strong oxidizing or reducing agent; (6) causes first degree burns to skin in short time exposure, or is systematically toxic on contact with the skin; and/or (7) in the course of normal operations may produce smoke, dusts, gases, fumes, vapors, or mists which have one or more of the above characteristics.
Health Hazard	--	Anything (including certain chemicals) that, according to at least one scientific study, may be harmful to the health. Chemicals classified as health hazards include those that are carcinogens; toxic or highly toxic agents; reproductive toxins; irritants; corrosives; sensitizers; hepatotoxins; neurotoxins; agents that act on the hematopoietic system; or agents which damage the lungs, skin, eyes, or mucous membranes.
Hematologic Disturbances	--	Blood disturbance
Hematuria	--	The presence of blood in the urine.
Hepatotoxin	--	A chemical which produces liver damage.
Hydrocarbons	--	Composed solely of carbon and hydrogen.
Hygroscopic	--	Readily absorbs moisture from the air.
Hypoxia	--	Insufficient oxygen especially as applied to body cells.
Immiscible	--	Liquids which will not mix with each other but will form two separate layers or will result in cloudiness or turbidity.
Incompatible	--	Materials that cause dangerous reactions when in contact with one another.
Infectious Agent	--	Source that causes infections either by inhalation, ingestion, or direct contact with the host material.

Inflammation	--	A morbid series of reactions produced in the tissues by an irritant; it is marked by an afflux of blood with exudation of plasma and leukocytes.
Ingestion	--	The taking in of a substance through the mouth; eating it.
Inhalation	--	The act of breathing in. This is the most common route of entry for chemicals.
Inhibitor	--	An agent that arrests or slows chemical action.
Injection	--	The entry of chemicals into the body by means of broken skin from sores, cuts, burns, or scratches.
Insoluble	--	A substance that is incapable of being dissolved.
Irodocyditis	--	Inflammation of both the iris and ciliary body of the eye.
Irritant	--	A chemical that is not corrosive, but that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. Also see dermatitis and sensitizer
Ketosis	--	The condition marked by excessive production of ketone bodies in the body.
Laboratory Scale	--	Work with the substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.
Laboratory Use	--	Handling or use of such chemicals in which all the following conditions are met: (1) Chemical manipulations are carried out on a "laboratory scale"; (2) Multiple chemical procedures or chemicals are used; (3) The procedures involved. are not part of the production process, nor in any way simulate a production process; and (4) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.
Latent Period	--	The period of time between exposure and the first manifestation of the damage.
Lead Intoxication	--	Lead absorption resulting from inhalation of lead dust or fumes, or from swallowing lead dust.
LEL	--	Lower explosive limit. See flammable (explosive) limits.

Lesion	--	Injury, damage, or abnormal change to body tissue or organs.
Lethal Concentration(LC)--		A concentration of a substance that is sufficient to kill a test animal.
Lethal Concentration 50	--	LC50 - See toxic inhalation LD50.
Metastasis	--	Transfer of a disease producing agency from the site of disease to another part of the body; a secondary metastatic growth of a malignant tumor.
Metabolism	--	The chemical changes whereby the body functions.
Mixture	--	A combination of two or more substances, which may be separated by mechanical means.
Mutagen	--	A chemical that causes a defect in sperm or egg cells prior to conception.
Narcosis	--	Stupor or unconsciousness produced by some narcotic agent.
Nausea	--	Tendency to vomit, feeling of sickness of the stomach.
Necrosis	--	Local death of tissue.
Nephrotoxins	--	Chemicals that primarily affect the nervous system.
Nystagmus	--	Spasmic, involuntary motion of the eyeballs, in either a horizontal, vertical, or circular pattern.
Olfactory	--	Pertaining to the sense of smell.
Oliguria	--	Scanty or low volume of urine.
Opaque	--	Impervious to light.
Oral	--	Through the mouth.
Oral Toxicity	--	Adverse effects resulting from taking a substance into the body via the mouth. Ordinarily used to denote the effects in experimental animals.
Organic Peroxides	--	Organic compounds that are highly reactive; some are unstable and may act as an explosive or oxidizer.

Oxidizer	--	A material, other than a blasting agent or an explosive that contains oxygen and may start or assist combustion in other materials. Examples are chromic acid, concentrated nitric acid, and potassium permanganate.
Oxidizing Agent	--	A material that releases oxygen atoms or accepts electrons during a chemical reaction.
Permissible Exposure Limit (PEL)	--	An exposure limit established by OSHA regulatory authority. See threshold limit value (TLV).
Personal Protective Equipment (PPE)	--	Devices worn by the worker to protect against hazards in the environment. Respirators, gloves, and ear protectors are examples.
pH	--	A measure used to quantify the level of acidity or alkalinity. Strong acids have a pH near 1, strong bases near 13, and a pH of 7 indicate neutrality.
Pneumoconiosis	--	Dusty lungs resulting from the continued inhalation of various kinds of dust and other particles.
Polymerization	--	A chemical reaction in which many small molecules combine covalently to form a larger one.
Protective Laboratory Practices and Equipment	--	Those laboratory procedures, practices, and equipment accepted by the laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals
Pulmonary Agents	--	Chemicals that may damage the lungs.
Pulmonary Edema	--	The condition of having fluid in the lungs.
Pyrophoric	--	A chemical that will ignite spontaneously and burn when exposed to air at temperatures below 130° F.
Reactivity	--	The ability of a material to undergo a chemical reaction.
Reducing Agent	--	A material which accepts oxygen atoms or gives up electrons in a reaction.

Reproductive Toxins	--	Chemicals which have a negative effect on the reproductive capabilities, including chromosomal damage (mutations) and birth defects to the fetus (teratogenesis).
Respirator	--	A device designed to protect the wearer from the inhalation of contaminated air
Respiratory Disease	--	Any disease that affects the lungs or the respiratory tract.
Respiratory Irritants	--	Any chemical that produces a reversible inflammatory effect on the respiratory system.
Safety Can	--	An OSHA-approved dosed container which has the following characteristics: (1) a capacity of not more than 5 gallons (19 liters); (Z) a spring-closing lid and spout cover; (3) flash-arresting screen; and (4) designed to safely relieve internal pressure if exposed to fire.
Saturation	--	The maximum concentration of matter that can be dissolved in a solution at a given temperature.
Sensitization	--	An allergic reaction that increases in severity with subsequent exposures. A person previously exposed to a certain material is more sensitive when further contact with this material is encountered.
Sensitizer	--	Chemicals that may cause an allergic reaction after one or more exposure. Once an individual becomes sensitized, a small dose of the material may cause a big effect. See dermatitis and irritant.
Skin Notation	--	A chemical that can penetrate unbroken skin.
Soluble	--	Capable of being dissolved.
Solubility	--	The ability of a material to dissolve in water or other solvent.
Solubility in Water	--	The percentage of a material (by weight) that will dissolve in water at ambient temperature. Terms used to express solubility are: negligible less than 0.1%

		slight	0.1 to 1.0%
		moderate	1 to 10%
		appreciable	more than 10%
		complete	soluble in any proportion
Spasm	--	An involuntary, convulsive, muscular contraction.	
Specific Gravity	--	A measurement used to quantify the weight of a substance by comparing the weight of a given volume of material to the same volume of water. Material with a specific gravity greater than 1 is heavier than water and will sink if it does not dissolve. Material with a specific gravity of less than one will float on the water if it does not dissolve. See solubility in water.	
Spontaneous Combustion--	--	Combustion resulting from a chemical reaction with the slow generation of heat from oxidation of organic compounds until the ignition temperature of the material (fuel) is reached. The condition is reached only where there is sufficient air from oxidation but not enough ventilation to carry away the heat as fast as it is generated.	
Stability	--	The tendency of a material to resist undesirable chemical changes during storage or transportation.	
Stupor	--	Partial or nearly complete unconsciousness.	
Synergistic	--	Pertaining to the action of two or more substances, organs or organisms to achieve an effect of which each is individually incapable.	
Systemic	--	Spread throughout the body and affecting all systems and organs; not localized in one spot or area.	
Tachycardia	--	Excessively rapid heartbeat.	
Target Organ	--	Primary organ in body attacked by a chemical.	
Teratogens	--	Chemicals that cause birth defects in a developing fetus.	
Thermal Decomposition	--	The breakdown of a material when heated.	
Threshold Limit Value (TLV)	--	The Threshold Limit Value (TLV) is a safe exposure level set by the American Conference of Governmental Industrial Hygienists (ACGIH). A Permissible Exposure Limit (PEL) is a similar level set by OSHA. Both refer to airborne concentrations of substances and represent an exposure level	

under which most people can work constantly for 8 hours a day, day after day, with no harmful effects. Three categories of TLVs are specified: (1) Time Weighted Average (TLV-TWA) - This is the time weighted average concentration for a normal 8-hour workday or 40-hour work week, to which all workers may normally be exposed day after day, without adverse effect; (2) Short Term Exposure Limit (TLV-STEL) - This is the maximum concentration to which workers can be exposed for a period of up to 15 minutes continuously without suffering from (a) irritation, (b) chronic or irreversible tissue change, or c) narcosis of sufficient degree to impair self-rescue or reduce work efficiency. No more than four 15-minute exposure periods per day are permitted with at least 60 minutes between those periods; (3) Ceiling (TLVC) - The concentration that should not be exceeded even instantaneously.

NOTE: If any of the above TLVs is exceeded, a potential hazard from that substance is presumed to exist.

- Tinnitus -- A ringing or singing sound in the ears.
- Toxemia -- Poisoning by way of the bloodstream.
- Toxic -- The toxicity chemicals can be measured using a variety of animal studies. OSHA uses three categories for this: (1) Oral LD50 - Lethal dose 50% test: the medium lethal dose that kills 50% of the albino white rats that received it. Oral LD50 is expressed as milligrams of chemical per kilogram of test animal body weight. A dose of one milligram per kilogram (mg/kg) is equal to 1 one millionth of the test animal's body weight. OSHA considers a chemical to be toxic if the Oral LD50 is between 60 mg/kg and 500 mg/kg; (2) Skin LD50 - A dose that kills 50% of the albino white rabbits that had the chemical applied directly to the bare skin for 24 hours. Skin LD50 is also expressed in mg/kg. OSHA considers a chemical to be toxic if the skin LD50 is between 200 mg/kg and 1000 mg/kg; (3) Inhalation LC50 - Lethal concentration 50%: the concentration of a chemical in the air needed to kill 50% of the albino white rats that breathed it. LD50 is expressed as parts per million (ppm) for bases and vapors. LD50 is also expressed as milligrams per liter (mg/l) for mists, fumes, and dust. See highly toxic.
- Toxicity -- The degree of injury or illness caused by a toxic material.

Unstable (Reactive)	--	A chemical which in pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.
UEL-Upper Explosive Limit		See flammable explosive limits.
Urticaria	--	Nettle-rash; hives; elevated itching, white patches.
Vapor Density	--	A measure of how heavy a vapor is compared to air, which has a vapor density of one. Vapors more dense than air accumulate close to the floor and in low spaces.
Vapor Pressure	--	A measure of how readily a material will evaporate and indicates how volatile a liquid is. The lower the vapor pressure, the slower it evaporates and the longer it takes to build up toxic or explosive concentrations.
Vertigo	--	A feeling of revolving in space; dizziness, giddiness.
Viscosity	--	Resistance to flow exhibited by a fluid.
Volatility	--	The tendency or ability of a liquid to vaporize.
Volatile Organic Compound (VOC)	--	An organic compound that evaporates.
Volatile Percent	--	The fraction by weight or volume of a chemical that evaporates in a mixture.
Water Reactive	--	A chemical that reacts with water.

C. MSDS Abbreviations and Symbols

ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Chemical Society
AIHA	American Industrial Hygiene Association
AMA	American Medical Association
ANSI	American National Standards Institute
AQTX	Aquatic Toxicity
ASTM	American Society for Testing and Materials
atm	atmosphere
BLS	Bureau of Labor Statistics
ca	(circa) about
CAR	Carcinogenic effects
CAS	Chemical Abstract Service
cc	cubic centimeter
XXXX	Closed Cup
(C)	Ceiling concentration
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CNS	Central Nervous System
COC	Cleveland Open Cup
conc	concentration
decomp	decompose or decomposition
DHHS	U.S. Department of Health and Human Services
DOL	U.S. Department of Labor of which the Occupational Safety and Health Administration (OSHA) is a part
DOT	Department of Transportation
EPA	Environmental Protection Agency
FR	Federal Register
G.I. or GI	Gastrointestinal
g or gm	gram
IARC	International Agency for Research on Cancer
inhl	inhalation
insol	insoluble
IRDS	Primary irritation dose
IRR	Irritation effects (systemic)
kg	kilogram (one thousand grams)
L	Liter
LC50	Lethal concentration to 50% of those tested (mean lethal concentration)
LDLo	Lowest possible lethal dose
LEL	Lower Explosive Limit
LFM	Linear Feet per Minute
m ³	cubic meter

mg	milligram (1/1000, 10 ⁻³ , of a gram)
gm/m ³	milligrams of substance per cubic meter of air
ml	milliliter
mm Hg	millimeters of Mercury
MLD	Mild
mppcf	millions of particles per cubic foot of air
MSDS	Material Safety Data Sheet(s)
MLV	Molecular Weight
n-	normal
NBS	National Bureau of Standards
NCI	National Cancer
NEO	Neoplastic effects
NFPA	National Fire Protection Agency
NIOSH	National of Occupational Safety and Health
NO _x	Oxides of Nitrogen
NTIS	National Technical Information Services
ng	nanogram (one-billionth, 10 ⁻⁹ , of a gram)
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
pH	Negative logarithm of the hydrogen ion concentration
PMCC	Pensky-Martens Closed Cup
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million part of air, parts per million
ppt	parts per trillion
PUL	Pulmonary
SCBAF	Self Contained Breathing Apparatus with Full Face piece
SCI	Specific Chemical Identity - means the chemical name, Chemical Abstracts Service (CAS) registry number, or any other information that reveals the precise chemical designator of the substance
SKN	Skin effects
soln	solution
SO _x	Oxides of sulphur
STEL	Short Term Exposure Limit
STP	Standard Temperature and Pressure
SYS	Systemic effects
TCC	Tg Closed Cup
TCLo	Lowest published toxic dose
temp	temperature
TER	Teratogenic effects
TFX	Toxic effects
TLm	Median Tolerance Limit
TLV	Threshold Limit Value
TOC	Tag Open Cup
torr	mm HG pressure
TWA	Time Weighted Average

UEL	Upper Explosive Limit
µg	Microgram (one-millionth, 10 ⁻⁶ , of a gram)
VOC	Volatile organic compounds
>	greater than
<	less than

D. RESPONSIBILITIES AND FUNCTIONS

1. University Chemical Hygiene Officer (CHO)

The University Chemical Hygiene Officer (CHO) is charged with the responsibility of implementing and monitoring the chemical hygiene plan. The Chemical Hygiene Officer at Drexel University is Martin W. Bell. The Drexel University CHO can be reached at (215) 895-5892.

The CHO's functions include, but are not limited to the following responsibilities:

- The development of chemical hygiene policies and procedures.
- Conduct safety inspections of all university spaces.
- Assist PI's in complying with federal and state regulatory agencies and developing a healthy workplace environment.
- Conduct implementation and monitoring procedures in accordance with approved policies and procedures.
- Certify the performance of protective equipment.
- Monitor procurement, use, and disposal of chemicals used in the lab
- See that appropriate audits are maintained.
- Help supervisors develop precautions and adequate facilities.
- Know the current legal requirements concerning regulated substances.

2. Principal investigator/Faculty Member/Laboratory Supervisor

The principal investigator/laboratory supervisor/faculty member has overall responsibility to:

- Ensure that workers know and follow the chemical hygiene rules that protective equipment is available and in working order, and that appropriate training has been provided.
- Provide regular, formal, chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.
- Know the current legal requirements concerning regulated substances.
- Determine the required levels of protective apparel and equipment.
- Ensure that facilities and the training for use of any material being ordered are adequate.

3. Laboratory employee/Student

The laboratory employee is responsible for:

- Planning and conducting each operation in accordance with Drexel University's chemical hygiene procedures.
- Developing good personal chemical hygiene habits

E. STANDARD OPERATING PROCEDURES

Because few laboratory chemicals are without hazards, and based on the premise that many mixtures of hazardous chemicals are more toxic than the most toxic component, the following procedures must be observed when working with most chemicals:

1. Chemical Exposures

- a. Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes), obtain information from MSDS and report to Employee/Student Health or nearest emergency room Safety and Health for evaluation.
- b. Ingestion: Call Emergency Operator (9-911), Poison Control Center or Chemtrec. Do not induce vomiting or drink large quantities of water unless directed to do so by a medical professional.
- c. Skin Contact: Promptly flush the affected area with water for 15 minutes. Remove all contaminated clothing. Use a safety shower when contact is extensive.

Note: In any of the above events, seek medical advice immediately. Phone or contact Drexel Security (215) 895-2222 and the University Department of Safety & Health at (215)-895-5907

2. Chemical Spills

In the event of a chemical spill immediately implement the appropriate spill control procedures as outlined below.

3. Chemical Spill Control Procedures

- a. Immediately turn off all ignition sources (i.e. open flame, heating mantle, etc.).
- b. If contaminated with Hazardous material, immediately implement Personal Decontamination Procedures reference above in the Chemical Exposure Section or refer to Appendix I.

c. Asses the Risk

- Identify material, (i.e. acid, caustic or solvent).
- Determine if spill is a major spill (500 ml or an acutely hazardous material, or a minor spill (<500 ml of non-acutely hazardous material). Refer to Appendix II for list of acutely Hazardous Materials.
- If major spill, implement the major spill procedures as outlined below in Item d. (Also, outlined in Appendix III).
- All minor spills (<500 ml of non-acutely hazardous materials) will be cleaned-up by Faculty Member/Laboratory Supervisor/Principle Investigator. If minor spill, implement the minor spill procedures as outlined below in Item e. (Minor Spill Clean-up Procedures, also, outlined in Appendix IV.)

d. In the event of a major spill in a university area, all laboratory, education, maintenance, outside contractor, administrative, and/or environmental services personnel will implement the following plan:

1. Notify persons in the immediate area that a spill has occurred.
2. Avoid breathing vapors, mists or dust of the spilled material.
3. Turn off all ignition sources.
4. Evacuate room and close the door
5. Contact the Emergency Operator

DREXEL UNIVERSITY - Phone # 80 (using any in-house phone)
Drexel – 215-895-2222

In order to asses the situation be prepared to provide the following information:

- Name and call back number
 - The location of the spill (building and room number)
 - Type of material spilled
 - The amount of material that spilled
6. Remain on or near the telephone until you have received instructions from the emergency operator or security or University Department of Safety & Health.
- e. In the event of a minor spill all laboratory personnel (Laboratory Supervisor/Laboratory Technician/Principle Investigator/Faculty Member) will implement the following steps when cleaning-up a minor chemical spill:

1. Review MSDS prior to clean-up.

2. Proper personnel protection equipment will be donned during clean up of all hazardous materials. Personnel protection equipment selection charts will be referenced prior to cleaning up any spilled material(s). If the laboratory personnel does not have the proper personal protective equipment then contact University Safety and Health for assistance
3. Contain spilled material(s) using absorbent pads and/or socks. **Paper Towels will not be used for containment of spill nor will they be used for clean up.**
4. Neutralize spilled material(s) using the appropriate neutralizing agent.
5. Clean up neutralized material using dustpan and/or plastic scoop.
6. Place neutralized material in hazardous waste bags. Dispose of as hazardous waste.
7. Wash area where spill has occurred with water several times making sure no residue was left behind. Dispose of any towels used as hazardous waste.
8. All emergency equipment shall be decontaminated and stored.
9. All non-disposable personal protective equipment shall be decontaminated and stored.
10. All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.
11. Always use extreme caution when cleaning up hazardous substances.

f. Report all minor spills involving the release of materials in quantities **greater than 100 milliliters** to the University Department of Safety & Health at 215-895-5907.

4. Work Area Precautions

- Keep all work areas clean and free of clutter. Clean up the work area on completion of an operation or at the end of each work shift or class.
- Keep chemicals and equipment properly labeled and stored appropriately. Segregate chemicals as noted in Part 9 of this section. (For more information on Compatible Storage, refer to Appendix V).
- Do not store, handle or consume food or beverages in laboratory areas, refrigerators, or with glassware or utensils that are also used for laboratory operation.
- Seek information and advice about hazards, review MSDS (www.hazard.com) plan appropriate protective procedures, and plan positioning of equipment before beginning new operation.
- Leave lights on during work hours.

- Provide for containment of toxic substances in the event of failure of a utility service in an unattended operation.
- **Chemical Fume Hoods**
 - Use a hood for operations that might result in release of chemical vapors or fine powders and dust. Respirators may be necessary for work with some substances. If a substance's OSHA permissible exposure limit (PEL) can be predicted to be exceeded then a respirator will be necessary for work with that substance. Refer to Appendix VI for the OSHA PELs. Laboratory personnel and/or students must fulfill all the requirements set forth by the University's Respirator Protection program prior to working with respirators.
 - As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance having a TLV of less than 500 ppm. Refer to Appendix VII for a list of some TLVs. This list is not the complete list of TLVs. Contact the University Department of Safety and Health for the TLVs not list in Appendix VII.
 - Confirm adequate hood performance before use (i.e. kimwipe test). Keep hood closed at all times except when adjustments within the hood are being made. Do not store chemicals in hoods for extended periods of time, and do not allow materials to block vents or airflow. Refer to the University's Chemical Fume Hood Plan for more details concerning chemical fume hoods.
 - Leave the hood "on" when it is not in active use, if toxic substances are stored in it; or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."
 - Be aware of any unsafe conditions and see that they are corrected when detected. Contact the University Department of Safety & Health for advice. The lab safety inspection form included in Appendix VIII of this manual will provide you with a list of items that should be inspected routinely.

5. Procedural Precautions

- Mouth suction for pipetting or starting a siphon is **strictly forbidden**.
- Do not smell or taste chemicals.
- Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into local exhaust devices or Chemical Fume Hoods.
- Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware.

- Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments in the event that implosion might occur.
- Use equipment only for its designed purpose.

Toxic Chemical Precautions

- Review the Material Safety Data Sheets prior to working with any toxic chemicals. Refer to the Appendix II for a list of toxic chemicals.
- Do not allow release of toxic substances in cold rooms or warm rooms, since these areas have contained re-circulated atmospheres.
- Do not use any chemicals that require ventilation in excess of your lab's capabilities. Most labs have between 6 and 12 air changes per hour. Chemicals requiring additional ventilation should be used only in hoods and glove boxes.
- Procedures involving highly toxic chemicals that can generate dust, vapors, or aerosols must be conducted in a hood, glove box, or other suitable containment device. Refer to Appendix to II for hazardous chemical lists.
- When working with toxic liquids or solids, it is critical that gloves be worn to protect the hands and forearms. These gloves must be carefully selected to ensure that they are impervious to the chemicals being used and are of appropriate thickness to allow reasonable dexterity while also ensuring adequate barrier protection. Contact the University Department of Safety & Health for assistance or glove selection.
- When using toxic substances that could generate vapors, aerosols, or dusts, additional levels of protection, including full-face shields and respirators, are appropriate, depending on the degree of the hazard represented.
- Equipment used for the handling of high toxic chemicals should be isolated from the general laboratory environment.
- After using toxic materials laboratory personnel shall wash his or her face, hands, neck and arms prior to leaving the laboratory.

Radioactive Material Precautions

- Prior to working with any radioactive material contact the Radiation Safety Department (215-255-7860) for the current regulations concerning radioactive materials.

- Know the characteristics of the radioisotopes that are being used, including half-life, types and energies of emitted radiations, the potential for exposure, how to detect contamination, and the annual limit on intake.
- Dispose of waste radionuclides and their solutions appropriately. Contact the Radiation Safety Department or the University Department of Safety and Health concerning proper disposal procedures.
- Plan experiments so as to minimize exposure by reducing the time of exposure, using shielding against exposure, increasing your distance from the radiation, and paying attention to monitoring and decontamination.
- Keep an accurate inventory of radioisotopes.
- Place only materials with known or suspected radioactive contamination in appropriate radioactive waste containers.

Flammable Material Precautions

- Handle flammable substances only in areas free of ignition sources. Besides open flames, ignition sources include electrical equipment (especially motors), static electricity, and, for some materials (e.g., carbon disulfide), even hot surfaces.
- Check the work area for flames or ignition sources prior to using a flammable substance.
- Never heat a flammable substance with an open flame. Preferred heat sources include steam baths, water baths, oil and wax baths, salt and sand baths, heating mantles, and hot air.
- Keep containers of flammable substances tightly closed at all times when not in use.
- Use only refrigeration equipment certified for storage of flammable materials.

6. Protective Clothing And Other Precautions

- Remove laboratory coats immediately upon significant contamination.
- Open-toed footwear cannot be worn in laboratories. Avoid wearing sandals, perforated shoes, sneakers or any shoes made of canvas.
- Shorts cannot be worn in Drexel University laboratories.
- Do not wear contact lenses in the laboratory.

- Disposable or special gloves, chemical aprons, goggles or eye shields must be used whenever appropriate.
- Disposable gloves must never be worn in hallways, elevators, or public areas of the university. If hazardous materials must be transported from one area to another, glove one hand to hold the product / apparatus or push cart and use a clean ungloved hand to open doors, press buttons, etc.
- Inspect all gloves before each use. Wash them before removal. Dispose of them appropriately.
- Reusable gloves should be washed and inspected before and after each use. Gloves that might be contaminated with chemicals should not be removed from the immediate area in which the chemicals are located.
- Eating, drinking, smoking, chewing gum or applying cosmetics in the laboratory is strictly forbidden. Lunches are not to be stored in standard laboratory refrigerators, but may be kept in the designated refrigerators.
- Wash areas of exposed skin thoroughly before leaving the laboratory.
- Confine long hair and loose clothing.
- Avoid practical jokes or other behavior that might confuse, startle or distract another worker.
- Refer to Section H of this plan for information concerning Personal Protective Equipment.

Note: Please contact the University Dept. of Safety and Health for additional information on precautionary measures, i.e., housekeeping, gas cylinders, hazard warnings, etc.

7. Chemical Inventory

An inventory of all hazardous chemicals (refer to Appendix II for a list of hazardous substances or to individual MSDS) and non-hazardous chemicals must be conducted in each laboratory. One copy of this inventory will be maintained by the P.I./Faculty Member, a second copy will be maintained in each lab as the first page of the MSDS book and a third electronic copy will be sent to the University Department of Safety & Health.

Additional inventories must be prepared annually. As new chemicals are obtained, chemical inventory sheets must be updated accordingly.

The PI/Laboratory Supervisor/Faculty Member takes complete responsibility for compliance.

8. Material Safety Data Sheets (MSDS)

MSDS must be kept in each laboratory in a labeled binder. The MSDS should be filed in alphabetical order along with the chemical inventory for that particular laboratory.

If MSDS are missing from a particular chemical inventory, request letters should be sent to the applicable manufacturer or vendor. Vendors and manufacturers are required by federal law to provide MSDS upon request, free of charge, within a reasonable time frame. Additional sources for obtaining MSDS include the internet at:

www.hazard.com,
<http://ntp-server.niehs.nih.gov/>, and
www.hhmi.org/science/labsafe/lcss/.

The PI/Laboratory Supervisor/Faculty Member is responsible to ensure that the entire MSDS book from each laboratory, including the chemical inventory and annual updates, is photocopied and sent to the University Department of Safety and Health, at Mail Stop 622.

The PI/Laboratory Supervisor/Faculty Member is responsible for reviewing the MSDS and recording which materials are carcinogenic, mutagenic or teratogenic. This information must be conveyed to all students and/or employees engaged in research in his/her laboratories, including locations used and stored within the lab. This information must be posted at the entrance to each lab in an effort to inform any individual who may need to enter that space. A copy of this information must be sent to the University Department of Safety and Health.

9. Chemical Storage

All hazardous chemicals must be stored in clearly defined designated areas in accordance with this manual and OSHA Regulation 29 CFR 1910.1450 also known as the “Laboratory Standard”. These storage guidelines must be followed when storing hazardous chemicals:

- The chemical inventory should be kept as small as possible.
- Do not store chemicals on top of high cabinets or shelves.
- Keep exits, passageways, areas under tables, and emergency equipment areas free of stored chemicals.
- Provide a definite storage place for each chemical and return the chemical to that location after each use.
- Avoid storing chemicals on bench tops and in fume hoods, except for those chemicals being used currently.
- Do not store chemicals on the floor.
- Store chemicals in a cool dry place avoiding direct sunlight.
- Ventilated storage cabinets shall be used to store extremely hazardous chemicals.
- Use chemical storage refrigerators only for chemical storage. Label these refrigerators with the following signage: “**No Food or Drink – Chemical Storage Only**”
- Do not store flammable liquids in a refrigerator unless it is an approved explosion-proof refrigerator.

- Safety containers must be used when transporting chemicals (i.e. carts, rubber totes, secondary containers etc).
 - Observe all precautions regarding the storage of incompatible chemicals.
 - Dry chemicals (solid materials) shall not be stored with liquid chemicals.
 - Separate chemicals into the following hazard classes:
 1. Flammables
 2. Acids
 - Organic Acids
 - Inorganic Acids
 3. Bases
 - Organic Bases
 - Inorganic Bases
 4. Oxidizers
 5. Reactives
 6. Poisons (Toxic)
 7. Non-hazardous or non-regulated chemicals.
-
- Store all flammable liquids in a flammable storage cabinet with self-closing doors.
 - Organic Acids can be stored in the flammable storage cabinet; however, overspill containers must be used to contain any spills.
 - Acids must be stored separate from bases. Storage in the same cabinet is possible **ONLY IF OVERSPILL CONTAINERS ARE USED TO CONTAIN ANY SPILLS.**
 - Separate inorganic and organic bases. These can be stored in the same cabinet. Shelves or overspill containers can be used as a means of separation.
 - Oxidizers must be stored in a cabinet separate from all other chemicals.
 - Reactive chemicals must be segregated and stored appropriately i.e. flammable cabinet, explosion proof refrigerator, dedicated container etc.
 - Toxic chemicals, including carcinogens, must be properly labeled; small containers should be stored together in unbreakable chemical-resistant secondary containers. These containers must be labeled either “Caution: High Chronic Toxicity,” or “Cancer Suspect Agent.”
 - As stated above, a separate inventory list of carcinogens, mutagens and teratogens is to be forwarded to the University Department of Safety and Health in accordance with Federal and State Regulations.
 - Alphabetical storage of all dry chemicals is not allowed. This may result in incompatibles appearing together on a shelf. Dry chemicals should first be segregated appropriately then stored alphabetically within each hazard class.
 - Cylinders of compressed gases, empty or full, must be labeled, strapped or chained at all times to a wall or bench top, and must be capped when not in use.
 - Oxygen and other oxidizing gases must not be stored adjacent to flammable gases (except when in use).
 - Do not store flammable gases near sources of heat or ignition.

- If unable to determine the best possible storage options consult the MSDS for the chemical. If further assistance is need contact the University Department of Safety and Health:
Martin Bell 215-895-5892
Phil Leo 215-895-5809

10. Labeling

OSHA requirements for labeling under the Chemical Hygiene Plan will be the same as those defined in the hazard communication standard 1910.1200. Therefore, all containers in the workplace must contain the following information:

1. Identity of the substance (complete chemical name).
2. Appropriate hazard warnings (completed NFPA diamond is acceptable).
3. Name and address of chemical manufacturer, importer, distributor, or other responsible party (if made in lab list laboratory contact).

All labels must be prominently displayed and legibly written (printed) in English and other language as appropriate for employees. **It is the responsibility of the principal investigator to inspect all incoming shipments of containers of hazardous chemicals to ensure that they bear labels with the appropriate information.**

If a container is improperly labeled, the PI/Laboratory Supervisor/Faculty Member or the PI's /Laboratory Supervisor's/Faculty Member's designee must contact the Safety Office (215-895-5907), who will notify the vendor for correction, and the receiving department for informational purposes.

Portable containers used for purposes of transferring hazardous material from a labeled container for immediate and complete use by an investigator or his /her technicians or research staff or student do not require labeling . However, if the transferred hazardous material is to be used by other research personnel/student, or is not immediately used, it is the responsibility of the investigator/lab supervisor/faculty member/student/lab technician for whom the chemical material was first intended, to properly label the portable container.

Place appropriate signs on the door. Remove all other materials from outer door surface (i.e. old labels, signs etc.)

The laboratory entrance door shall be labeled as follows:

1. NFPA diamond. Laboratory personnel shall fill in the diamond with the highest hazard number pertaining to their laboratory.
2. Biohazard label and appropriate Biosafety Level (if applicable).
3. Radiation Hazard Label (if applicable).
4. Emergency contact information. The information should include a name and number to contact in the event of an emergency. It must be clearly visible and placed in one of two locations:
 - a. Outer laboratory door

5. Additional warning labels as applicable, i.e. “carcinogen in use”, “water reactive materials”, “inhalation hazard, respiratory protection required in this area”, “high noise, hearing protection required in this area”, etc.

All cabinets, shelves and refrigerators containing chemical storage (including the cleaning supplies) must be labeled with the appropriate warning label (i.e. Flammable, Acids, Bases, Oxidizers etc). Refrigerators used for chemical storage must be labeled, with appropriate hazard warnings and with the signage: “NO Food or Drink – Chemicals Storage Only.” Any refrigerator used of food or drink storage must be label as such.

F. ENGINEERING CONTROLS

1. Chemical Fume Hoods, Biological Safety Cabinets and Ventilation

All chemical fume hoods and laminar flow hoods must be inspected annually and certified. Any hood not providing 80 to 120 linear feet per minute of airflow or manufactures recommended value must not be used. Inspections of chemical fume hoods are routinely conducted by the University Department of Safety & Health at no cost to the investigator or department. If chemical fume hoods do not meet specifications, they will be taken out of service immediately and are not to be used until the hood has met the criteria for certification. Refer to the University’s Chemical Fume Hood Policy for more information.

The annual inspection and certification of laminar flow hoods and biosafety cabinets is scheduled through the University Department of Safety & Health, the costs associated with these certifications are the investigator’s/faculty member’s responsibility. It is the responsibility of the principal investigator/faculty member/laboratory supervisor to certify, repair or replace such unit(s) in a timely fashion so as not to endanger the health and well-being of employees/students or place them at risk. Refer to the University’s Biological Safety Cabinet Policy for more information.

Work involving chemicals with high vapor pressures or low threshold limit values (TLVS) should always be done within a fume hood. Refer to Appendix VII for TLVs or contact the Safety Office (215-895-5907) for chemicals not on the list.

Airflow through each laboratory should normally be not less than 20 cubic feet per minute, and exhausted to the exterior of the building. Quality and quantity of ventilation are monitored and records are maintained by Drexel University Facilities Management. If you need information on this, please contact Drexel Facilities.

2. Eyewash Fountains and Safety Showers

Eyewash fountains must be inspected every once a week by the PI/Faculty Member/Laboratory Supervisor and records are maintained by the principal investigator/Faculty Member/Laboratory Supervisor. Inspection forms are included in the Appendix IX of this manual.

The University Department of Safety and Health inspects eyewash station during the quarterly laboratory audits and requires an annual certification. All records will be maintained by the University Department of Safety and Health.

Safety showers are inspected, tested, and flushed annually and records are maintained by the University Department of Safety and Health. Inspection forms are included in the Appendix IX of this manual.

3. Fire Safety

All laboratory personnel and/or students shall know the locations of the locations of all the fire extinguishers, fire blankets (if present) and the fire alarms.

The Principle Investigator/Laboratory Supervisor/Faculty Member shall post laboratory evacuation procedures. All laboratory personnel and students shall be familiar with these evacuation procedures.

Fire extinguishers are inspected annually and recharged and/or replaced accordingly by the Facilities Dept., contact (215) 895-2808 for service.

Long-term storage of chemicals should be in a well-ventilated, secure chemical storage area in accordance with NFPA requirements.

All cold rooms and warm rooms have provisions for rapid escape in the event of electrical failure. Escape instructions should be posted on the inside of the entrance door of each cold or warm room.

G. PERSONAL EXPOSURE MONITORING

Upon request of the PI/Faculty Member/Laboratory Supervisor/Student/Laboratory personnel, the University CHO will review laboratory work practices and normal operations in an effort to determine if Drexel employees are at risk of exposure to regulated substances in accordance with the OSHA permissible exposure limits and action levels as outlined in 29 CFR 1910.

Initial and annual surveillance monitoring (environmental and personal) will be conducted whenever exposures to hazardous agents are anticipated to exceed the action level, the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV) or OSHA'S PEL. Additionally, monitoring will be conducted when:

- Past monitoring has indicated elevated exposures,
- When requested by an employee or student,
- When an employee or student experiences signs or symptoms of overexposure, or

- When laboratory operations change such that an area previously identified as not expected to have significant exposure would now be expected to have elevated concentrations of hazardous agents

All personal exposure monitoring activities (including sampling, analysis and record keeping) will be performed in accordance with OSHA requirements and/or NIOSH recommended practices.

H. PERSONAL PROTECTIVE EQUIPMENT

The University Department of Safety and Health requires that appropriate eye protection is worn by all persons in laboratories and areas where chemicals are used or stored.

Eye protection consists of safety glasses with side shields, goggles or face shield, or full-face respirator. Chin-length face shields are to be worn to prevent splashes or sprays of blood, infectious materials, or hazardous chemicals when there is a potential for eye, nose, or mouth contamination.

Employees/students are required to wear appropriate gloves when an employee has the potential for direct contact with blood, hazardous chemicals, infectious agents, or other hazardous materials.

Select gloves appropriate for the task. Gloves protect differently for each chemical. For more information concerning glove selection contact University Department of Safety & Health.

Lab coats and gloves must be worn only in the laboratory area and are to be removed upon exiting the laboratory. Lab coats are worn to protect street clothes from hazardous materials.

When the use of respirators, in research laboratories, is necessary to maintain exposure below the permissible exposure limit (PEL), the respirator will be provided by the PI at no cost to the employee. The University Department of Safety and Health will provide students, at no cost, with respirators when the use is necessary to maintain exposure below the permissible exposure limit (PEL).

The proper respiratory equipment can be obtained from the University Department of Safety & Health (215) 895-5907. The respirators shall be selected and used in accordance with the requirement of 29 CFR 1910.134 and ANSI Z88.2-1969. Training, an annual physical and pulmonary function test will be required for all individuals requiring the use of respirators in accordance with OSHA's standards on respiratory protection 29 CFR 1910.134.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. The odor threshold for many chemicals is much lower than the permissible exposure limit, and in many circumstances is a great indicator of exposure. Refer to the Odor Threshold Chart, Appendix VII, and the OSHA PEL list, Appendix VI, to determine if a respirator is required.

The requirements set forth in the University's Respirator Protection Policy must be fulfilled prior to performing work with a respirator. Contact the University Department of Safety and Health to enroll in the program.

Use any other protective apparel and equipment as appropriate. Know the locations of PPE and how to obtain additional materials when necessary. If appropriate PPE is not readily available do not initiate experiments involving hazardous chemicals.

The Principle Investigator shall provide proper personal protection equipment for all personal in the research laboratory.

Faculty Members/Laboratory Supervisors shall require students to obtain the appropriate PPE prior to commencing any laboratory activities. For proper PPE selection contact the University Department of Safety and Health.

I. WASTE REMOVAL/DISPOSAL

The Waste Disposal Program provided at Drexel University for the collection, segregation, storing, transport, and incineration of contaminated materials is designed in accordance with the Pennsylvania Department of Environmental Protection (PADEP), the US Environmental Protection Agency (EPA) and the US Department of Transportation (USDOT) to minimize possible harm to people, other organisms and the environment. Refer to the university's hazardous waste management plan for waste removal/ disposal operations.

1. Drain Disposal

The University Department of Safety & Health will permit drain disposal of elementary neutralized (ph adjustment of waste that are hazardous only because they exhibit the corrosivity characteristic) acidic and caustic aqueous solutions. The elementary neutralized aqueous solution must have a final ph value between 6 and 9. Disposal must not exceed a rate greater than 50 ml/min. while flushing. These compounds should be flushed with at least 10 volumes of excess water.

The University Department of Safety & Health shall prohibit the drain disposal of the following:

- Flammable or explosive pollutants
- Pollutants that will cause corrosive structural damage to the Publicly Owned Treatment Works (POTW), but in no case discharges with pH lower than 5.0.
- Solid or viscous pollutants that may cause an obstruction of flow in the POTW
- Pollutants capable of releasing fumes or vapors
- Pollutants, including oxygen-demanding pollutants (high biological oxygen demand), which may cause interference with the POTW
- Wastewater with sufficient heat to inhibit biological activity in the POTW (must not exceed 104 F at the POTW)

- Petroleum, oil, non-biodegradable cutting oil or products of mineral oil origin in amounts that will cause interference or pass through
- No organic chemicals
- No heavy metal solutions

2. Incineration

Incineration, in an environmentally acceptable manner, is the most practical disposal method for combustible laboratory waste. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.

3. Hoods and recycling

Hoods are not to be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination must be used whenever possible.

4. Waste removal

Researchers rid their labs of unwanted materials by completing the Chemical Pick-Up Request Form (see the Appendix X of this Plan) and faxing it to the University Department of Safety and Health at (215) 895-5926. Waste is removed from the laboratories to the long-term central waste storage area at regular intervals. Storage is allowed from the generation of the waste up to 90 days. Drexel University stores its hazardous waste at its central storage area from which it is transported every 90 days for disposal.

Residual materials (less than 1 milliliter) may be rinsed from containers and disposed of down the drain. The remaining glassware should be cleaned, triple rinsed, labels defaced, and disposed of as municipal waste. All broken glassware should be disposed of in approved sharps containers.

Refer to the University's Hazardous Waste Management Plan for more information on waste disposal.

J. ADMINISTRATIVE CONTROLS

The safe operation of each laboratory is the responsibility of the respective PI/Faculty Member/Laboratory Supervisor, while the overall responsibility for the enforcement of the chemical hygiene plan rests with the University Department of Safety and Health. Policy and implementation procedures pertaining to the CHP require approval by the University Department of Safety and Health.

The administrative controls enforced at Drexel University include, but are not limited to:

1. Restricted access and proper signage on all entrances leading to areas containing agents that may be immediately dangerous to life or health.

2. Proper labeling on laboratory doors, cabinets and containers containing potentially hazardous materials.
3. The observation of Standard Universal Precautions when working with blood and bodily fluids of humans and animals, recombinant DNA or potentially pathogenic bacterial or viral agents.
4. The contents of the lab safety manual and the radiation safety manual and all applicable federal and state regulations established to protect human health and the environment.
5. If a chemical is produced for another user at Drexel University or at another facility, the researcher shall comply with the hazard communication standard 29 CFR 1910.1200 (www.osha.gov/comp-links.html), including the requirements for preparation of material safety data sheets and labeling.
6. Environmental monitoring is required in all laboratories using the chemicals listed in OSHA Standard 1910 Subpart Z - Toxic And Hazardous Substances that would generate anticipated exposures in excess of the action level or the TLV.
7. Chemical spill response must be performed in accordance with this manual. Laboratory personnel are responsible for cleaning up spills of materials that are not acutely hazardous in quantities of less than 500 ml. Laboratory personnel are responsible for containing and reporting larger spills and/or spills of acutely hazardous materials such as phenol.
8. Procedures for containing and/or cleaning chemical spills have been developed in accordance with OSHA guidelines and are described in Section E, Part 3 of this Plan.
9. All chemical spills greater than 100 milliliters must be reported to the University Department of Safety and Health immediately at (215) 895-5907.
10. To contain a chemical spill, remember to “**C.L.E.A.N.**”
 - a. **C**ontain the area.
 - b. **L**eave the area.
 - c. **E**mergency: eye wash, shower, medical care.
 - d. **A**ccess MSDS.
 - e. **N**otify the CHO.
11. Appropriate spill kits must be maintained in each lab or in centralized common areas accessible by all lab personnel. It is the responsibility of the PI/Faculty Member/Laboratory Supervisor to ensure that ample spill materials are available and that laboratory personnel are familiar with locations and use of these materials.

K. MEDICAL CONSULTATIONS AND EXAMINATIONS

The principal investigator or lab supervisor is authorized to obtain pre-employment medical services from:

University Main Campus:	Employee/Student Health Office, located at Presbyterian Hospital 39th & Powelton Avenue, (215) 662-8233
Center City/MCP/QL	Novacare, (located on the 1st floor of the Bobst Building 245 N. 15th Street, (215) 762-8590

Including appropriate vaccinations, baseline medical monitoring and physicals as required under federal and state regulations for those individuals who have a potential for exposure. Additional medical services / consultations may be recommended by the University Department of Safety & Health prior to the approval of protocols involving the use of extremely hazardous or pathogenic agents.

The principal investigator or lab supervisor is authorized to obtain medical consultation in work-related emergency cases. All employees needing medical attention will use:

University City Main	See location above
Center City/MCP/QL	See location above

All injury-related examinations and consultations are performed by or under the direct supervision of one of panel of licensed physician's without cost to the employee, without loss of pay, and at a reasonable time and place.

The employee is sent for medical evaluation:

1. Whenever signs and symptoms associated with a hazardous chemical develop.
2. When environmental monitoring reveals an exposure level routinely above the action level.
3. Whenever an event takes place in the work area such as a spill, leak, or explosion resulting in hazardous chemical exposure.

The employee's supervisor, Risk Management or University Department of Safety & Health will provide the following information to the physician:

1. Identity of the hazardous chemical(s) to which the employee may have been exposed.
2. A description of the conditions under which the exposure occurred, including quantitative exposure data (if available).
3. A description of the signs and symptoms of exposure.
4. A copy of the MSDS for the chemicals involved.

The physician will provide a written opinion that will not reveal specific findings of diagnosis unrelated to the exposure but will include:

1. Any recommendation for further medical follow-up.
2. Results of the medical examination and any associated tests.
3. Any medical condition that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
4. A statement by the physician that the employee has been informed of the consultation and examination results and any medical condition that may require further examination or treatment.

All such medical records will be kept for at least as long as the employees affected are employed. OSHA requires some records to be kept for 30 years beyond the employee's time of employment. The laboratory standard requires that all records be maintained of all exposure evaluations, medical consultations, and reports and that those records be maintained in accordance to 29 CFR 1910.20. That section requires those records to be maintained for at least 30 years and describes the accessibility procedure for maintaining the records.

L. TRAINING

Training is a necessary and important part of the Chemical Hygiene Plan (CHP). All employees will be trained at the time of their initial assignment to a work area where hazardous chemicals are present. The PI or the PI's designee is responsible for training all employee(s) whose assignment(s) are to a work in an area where hazardous chemicals are, or may be present. For this purpose, supervisors may be trained by the Chemical Hygiene Officer through "train-the-trainer" sessions. Such sessions shall be documented by written attendance records.

The following is a list of the lesson plan for that session:

Objectives

Upon completion of the chemical hygiene training program, the employee will be able to:

- A. Locate the hazardous chemicals in the workplace and identify them as carcinogenic, mutagenic, teratogenic, poisonous, flammable or caustic as strong acids or bases.
- B. Recognize the chemical labeling (NFPA) and understand its meaning.
- C. Locate the MSDS file in the lab, university and on the web (www.hazard.com/MSDS)
- D. Locate the health hazard, physical hazard, environmental protection, and special protection sections of the MSDS and explain their usage.
- E. Identify the name and contact number of the Emergency Operator, Security, the Chemical Hygiene Officer and the PI. Discuss the major components of the facility's standard labeling system for hazardous waste.

- G. Identify appropriate protective clothing associated with their job and demonstrate its use.
- H. Demonstrate emergency procedures in the event of a fire or hazardous chemical spill.
- I. Describe the environmental monitoring protocol.

Training Program

- a. Content of the OSHA laboratory standard and hazard communication standard
- b. Location of CHP
- c. Identification of hazardous chemicals
 - 1. Location of chemical inventory
 - 2. Location of MSDS
 - a. MSDS book in lab
 - b. University safety office
 - c. www.hazard.com/MSDS
 - 3. Labeling information
 - a. Hazard warnings – NFPA diamond
 - b. Carcinogen, teratogen, mutagen warnings
 - c. Location in workplace
 - 4. Procedures for handling hazardous chemicals
 - a. Work practices
 - b. Proper moving, storage, and use
 - c. PEL for specific chemicals used by the employees
 - d. Visual appearance of chemicals used by the employee
 - e. Environmental monitoring required
 - f. Signs and symptoms of exposure
 - g. Location of target organ poster
 - h. Protective equipment used to prevent overexposure
 - i. Locations of eyewash and emergency shower, fire extinguishers, fire alarm pull stations, emergency exit and alternative exit
 - j. Conditions to avoid
 - 5. Environmental protection
 - a. Emergency procedures
 - b. Spill containment
 - c. Medical consultation procedures
 - 6. Documentation of training – sign in sheet with date, location, printed name, signature, social security number, department, title, contact number, name and title of trainer.

All employees trained by the supervisor must be documented as noted above. Copies of this documentation must be forwarded to the University Department of Safety and Health.

M. HOUSEKEEPING

Environmental services responsibilities at Drexel University are performed under the supervision of the Facility Department Environmental Services Supervisor and that individual is charged with the responsibility to supervise the performance of the following functions:

- Maintain the floors of laboratories, hallways and all areas of Drexel University in clean condition and free of obstruction.
- Removal of municipal which has been deposited in appropriate receptacles and properly removed from laboratory areas.
- Assist, when so directed, to clean spills of bodily fluids.
- Assist in obtaining proper storage to minimize clutter.
- Conduct training and instructional programs to ensure that all housekeeping employees are fully informed about the risks associated with laboratory research and all other activities at Drexel University.

Laboratory personnel/students shall keep all work areas, (i.e. bench tops, fume hoods, floor, emergency equipment, refrigerators, etc.), clean and free from clutter.

N. RECORDKEEPING

Drexel University will establish and maintain an accurate record for each employee requiring environmental monitoring, medical consultations, and examinations, including tests or written opinion as required.

Accident Reports are written by the PI or lab supervisor. They are forwarded to the University Department of Safety & Health. All workers' compensation claims and accidents that require hospitalization are filed accordingly.

Inventory records for high-risk substances must be maintained by the PI. A copy of the inventory must be sent to the University Department of Safety & Health.

Environmental monitoring records are maintained by the University Department of Safety & Health.

Medical consultation records are maintained by Employee Student Health. Drexel Human Resources Department will maintain a digital database outlining the pre-employment services that have been provided to each employee.

Training attendance records are maintained by the University Department of Safety & Health.

All records are kept, transferred, and made available for regulatory agencies and in accordance with 29 CFR 1910.20.

O. DOCUMENTS OF REFERENCE

The following documents were used for reference purposes. Copies of these documents are available in the University Department of Safety & Health.

1. Federal Register - Part II, Department of Labor, Occupational Safety and Health Administration 29 CFR Part 1910. "Occupational Exposures to Hazardous Chemicals in Laboratories"; Final Rule.
2. Furr, A. K.(2000).*CRC Handbook of Laboratory Safety*.5th ed.United States:CRC Press LLC.
3. National Research Council.(2000).*Prudent Practices in the Laboratory – Handling and Disposal of Chemicals*.3rd ed.United States:National Academy Press.
4. American Chemical Society.(1995).*Safety in Academic Chemistry Laboratories*.6th ed.United States:American Chemical Society.

APPENDICES

APPENDIX I

APPENDIX I

Personal Decontamination Procedures

If injured or contaminated with a hazardous substance these procedures will be implemented **immediately** prior to cleaning up or reporting spill.

- For spills contacting the of skin, follow these procedures:
 1. Immediately flush with flowing water for no less than 15 minutes (i.e. sink or safety shower).
 2. If there is no visible burn, wash with warm water and soap, removing any jewelry to facilitate clearing of any residual material.
 3. Check the material safety data sheet to see if any delayed effects should be expected. If the MSDS is not available contact University Department of Safety and Health immediately.
 4. Seek medical attention for even minor chemical burns.
 5. Do not use creams, lotions, or salves.

- For spills on clothing, follow these procedures:
 1. Do not attempt to wipe the clothes.
 2. Quickly remove all contaminated clothing, shoes, and jewelry while using the safety shower.
 3. Seconds count, so do not waste time because of modesty
 4. Take care not to spread the chemical on the skin or, especially, in the eyes.
 5. Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes; it may be better to cut the garments off.
 6. Immediately flood the affected body area with warm water for no less than 15 minutes. Resume if pain returns.
 7. Get medical attention as soon as possible. Discard contaminated clothes as hazardous waste or have them laundered separately from other clothing.

- For splashes into the eye, take these steps:
 1. Using the eyewash immediately flush for at least 15 minutes.
 2. Hold the eyelids away from the eyeball, and move the eye up and down and sideways to wash thoroughly behind the eyelids.
 3. Get medical attention immediately. Follow first aid by prompt treatment by a member of a medical staff or an ophthalmologist who is acquainted with chemical injuries.

APPENDIX II

Appendix II - Acutely Hazardous Material

P LIST

Hazardous Waste No.	TOXIC CHEMICALS Substance
P023	Acetaldehyde, chloro
P002	Acetamide, N-(aminothioxomethyl)
P057	Acetamide, 2-fluoro
P058	Acetic acid, fluoro-, sodium salt
P002	1-Acetyl-2-thiourea
P003	Acrolein
P070	Aldicarb
P203	Aldicarb sulfone.
P004	Aldrin
P005	Allyl alcohol
P006	Aluminum phosphide (R,T)
P007	5-(Aminomethyl)-3-isoxazolol
P008	4-Aminopyridine
P009	Ammonium picrate (R)
P119	Ammonium vanadate
P099	Argentate(1-), bis(cyano-C)-, potassium
P010	Arsenic acid H ₃ AsO ₄
P012	Arsenic Oxide As ₂ O ₃
P011	Arsenic oxide As ₂ O ₃
P011	Arsenic pentoxide
P012	Arsenic trioxide
P038	Arsine, diethyl
P036	Arsonous dichloride, phenyl
P054	Aziridine
P067	Aziridine, 2-methyl
P013	Barium cyanide
P024	Benzenamine, 4-chloro
P077	Benzenamine, 4-nitro
P028	Benzene, (chloromethyl)-
P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)
P046	Benzeneethanamine, alpha,alpha-dimethyl
P014	Benzenethiol
P127	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate
P188	Benzoic acid, 2-hydroxy-, compd. with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-tdimethylpyrrolo[2,3

P001	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations
P028	Benzyl chloride
P015	Beryllium powder
P017	Bromoacetone
P018	Brocine
P045	2-Butanone, 3,3-dimethyl-1-(methylthio)-,
P021	Calcium cyanide
P021	Calcium cyanide Ca(CN):
P189	Carbamic acid, [(dibutylamino)- thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester
P191	Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]- 5-methyl-1H- pyrazol-3-yl ester.
P192	Carbamic acid, dimethyl-, 3-methyl-1- (1-methylethyl)-1H- pyrazol-5-yl ester.
P190	Carbamic acid, methyl-, 3-methylphenyl ester.
P127	Carbofuran.
P022	Carbon disulfide
P095	Carbonic dichloride
P189	Carbosulfan.
P023	Chloroacetaldehyde
P024	p-Chloroaniline
P026	1-(o-Chlorophenyl)thiourea
P027	3-Chloropropionitrile
P029	Copper cyanide
P029	Copper cyanide Cu(CN)
P202	m-Cumenyl methylcarbamate.
P030	Cyanides (soluble cyanide salts), not otherwise specified
P031	Cyanogen
P033	Cyanogen chloride
P033	Cyanogen chloride (CN)Cl
P034	2-Cyclohexyl-4,6-dinitrophenol
P016	Dichloromethyl ether
P036	Dichlorophenylarsine
P037	Dieldrin
P038	Diethylarsine
P041	Diethyl-p-nitrophenyl phosphate
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	Diisopropylfluorophosphate (DFP)
P004	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a; hexahydro- (alpha,4alpha,4abeta,5alpha,8alpha,8abeta)
PO60	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a-hexahydro-,

(1alpha,4a]pha,4abeta,5beta,8beta.8abeta)
 2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,ea,7,7a-
 P037 octahydro-
 (1aalpha,2beta,2aalpha.3beta,6beta,6aalpha,7beta, 7aalpha)
 P051
 (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta, 7aalphay, & metabolites
 P044 Dimethoate
 P046 alpha, alpha-Dimethylphenethylamine
 P191 Dimetilan.
 P047 4,6-Dinitro-o-cresol, & salts
 P048 2,4-Dinitrophenol
 P020 Dinoseb
 P085 Diphosphoramidate, octamethyl
 P711 Diphosphoric acid, tetraethyl ester
 P039 Disulfoton
 P049 Dithiobiuret
 P785 1,3-Dithiolane-2carboxaldehyde, 2,4-dimethyl-, O- [(methylamino)- carbonyl]oxime.
 P050 Endosulfan
 PO88 Endothall
 P051 Endrin
 P051 Endrin, & metabolites
 P042 Epinephrine
 P031 Ethanedinitrile
 P194 Ethanimidothioic acid, 2-(dimethylamino)-N-[[[(methylamino) carbonyl]oxy]-2-oxo-,
 methyl ester.
 P066 Ethanimidothioic acid,
 P701 Ethyl cyanide
 P054 Ethyleneimine
 P097 Famphur
 P056 Fluorine
 P057 Fluoroacetamide
 P058 Fluoroacetic acid, sodium salt
 P798 Formetanate hydrochloride.
 P197 Formparanate.
 P065 Fulminic acid, mercury(2+) salt (R,T)
 P059 Heptachlor
 P062 Hexaethyltetraphosphate
 P116 Hydrazinecarbothioamide
 P068 Hydrazine, methyl
 P063 Hydrocyanic acid
 P063 Hydrogen cyanide

P096 Hydrogen phosphide
 P060 Isodrin
 P192 Isolan.
 P202 3-Isopropylphenyl N-methylcarbamate.
 P007 3(2H)-Isoxazolone, 5-(aminomethyl)
 P196 Manganese, bis(dimethylcarbamodithioato-S,S')-,
 P196 Manganese dimethyldithiocarbamate.
 P092 Mercury, (acetato-0)phenyl
 P065 Mercury fulminate (R,T)
 P082 Methanamine, N-methyl-N-nitroso
 P064 Methane, isocyanato
 P016 Methane, oxybis[chloro
 P712 Methane, tetranitro- (R)
 P118 Methanethiol, trichloro
 P798
 P197 Methanimidamide, N,N-dimethyl-N'-[2-methyl-4-
 [[(methylamino)carbonyl]oxy]phenyl]
 P050 6,9-Methano-2.4,3-benzodioxathiepin, 6,7,8,9,10,10
 P059 4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro
 P199 Melhiocarb.
 P066 Methomyl
 P068 Methyl hydrazine
 P064 Methyl isocyanate
 P069 2-Methylactonitrile
 P071 Methyl parathion
 P790 Metolcarb.
 P128 Mexacarbate.
 P072 alpha-Naphthylthiourea
 P073 Nickel carbonyl
 P073 Nickel carbonyl Ni(CO)₄, (T-4)
 P074 Nickel cyanide
 P074 Nickel cynaide Ni(CN):
 P075 Nicotine, & salts
 P076 Nitric oxide
 P077 p-Nitroaniline
 P078 Nitrogen dioxide
 P076 Nitrogen oxide NO
 P078 Nitrogen oxide NO,
 P081 Nitroglycerine (R)
 P082 N-Nitrosodimethylamine
 P084 N-Nitrosomethylvinylamine

P085 Octamethylpyrophosphoramidate
 P087 Osmium oxide 0\$0,, (T-4)
 P087 Osmium tetroxide
 P088 7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
 P794 Oxamyl.
 P089 Parathion
 P034 Phenol, 2-cyclohexyl-4,6-dinitro
 P048 Phenol, 2,4-dinitro
 P047 Phenol, 2-methyl-4,6-dinitro-, 8 salts
 P020 Phenol, 2-(1-methylpropyl)-4,6-dinitro
 P009 Phenol, 2,4,6-trinitro-, ammonium salt (R)
 P128 Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester).
 P199 Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
 P202 Phenol, 3-(1-methylethyl)-, methyl carbamate.
 P201 Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate.
 P092 Phenylmercury acetate
 P093 Phenylthiourea
 P094 Phorate
 P095 Phosgene
 P096 Phosphine
 P041 Phosphoric acid, diethyl 4-nitrophenyl ester
 P039 Phosphorodithioic acid, 0,0-diethyl
 P094 Phosphorodithioic acid, 0,0-diethyl
 P044 Phosphorodithioic acid, 0,0-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
 P043 Phosphorofluondic acid, bis(1-methylethyl) ester
 P089 Phosphorothioic acid, 0,0-diethyl O-(4-nitrophenyl) ester
 P040 Phosphorothioic acid, 0,0-diethyl O-pyrazinyl ester
 P097 Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] 0,0-dimethyl ester
 P071 Phosphorothioic acid, 0,0.-dimethyl 0.(4-nitrophenyl) ester
 P204 Physostigmine.
 P188 Physostigmine salicylate.
 Pilo Plumbane, tetraethyl
 P098 Potassium cyanide
 P098 Potassium cyanide K(CN)
 P099 Potassium silver cyanide
 P201 Promecarb
 P070 Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
 P203 Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl] oxime.
 P101 Propanenitrile
 P027 Propanenitrile, 3-chloro
 P069 Propanenitrile, 2-hydroxy-2-methyl

P081 1,2,3-Propanetdol, trinitrate (R)
 P017 2-Propanone,1-bromo
 P102 Propargyl alcohol
 P003 2-Propenal
 P005 2-Propen-1-ol
 P0671, 2-Propylenimine
 P102 2-Propyn-1-ol
 P008 4-Pyridinamine
 P075 Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, 8 salts
 P204
 P114 Selenious acid, dilhallium(1+) salt
 P104 Silver cyanide
 P104 Silver cyanide Ag(CN)
 P105 Sodium azide
 P106 Sodium cyanide
 P106 Sodium cyanide Na(CN)
 P108 Strychnidin-10-one, & salts
 P018 Strychnidin-10-one, 2,3-dimethoxy
 P108 Strychnine, & salts
 P115 Sulfuric acid, dithallium(1+) salt
 P109 Tetraethyldithiopyrophosphate
 P110 Tetraethyl lead
 P111 Tetraethyl pyrophosphate
 P112 Tetranilromethane (R)
 P062 Tetrphosphoric acid, hexaethyl ester
 P113 Thallic oxide
 P713 Thallium oxide Tlz O,
 P114 Thallium(I) selenite
 P115 Thallium(I) sulfate
 P109 Thiodiphosphoric acid, tetraethyl ester
 P045 Thiofanox
 P049 Thioimidodicarbonic diamide [(H= N)C(S)1= NH
 P014 Thiophenol
 P116 Thiosemicarbazide
 P026 Thiourea, (2-chlorophenyl)
 P072 Thiourea, 1-naphthalenyl
 P093 Thiourea, phenyl
 P185 Tirpate.
 P123 Toxaphene
 P118 Trichloromethanethiol
 P119 Vanadic acid, ammonium salt

P120 Vanadium oxide V_ OS
 P120 Vanadium pentoxide
 P084 Vinylamine, N-methyl-N-nitroso
 P103 Selenourea
 P001 Warfarin, & salts, when present at concentrations greater than 0.3
 P205 Zinc, bis(dimethylcarbamo-dithioalo-S,S')-,
 P121 Zinc cyanide
 P121 Zinc cyanide Zn(CN)=
 P122 Zinc phosphide Zn₃ P₂, when present at concentrations greater than 10% (R,T)
 P205 Ziram
 U007 Acrylamide
 U135 Hydrogen sulfide
 U135 Hydrogen sulfide H₂S
 U151 Mercury
 U188 Phenol
 See F027 2,4,5-T
 U207 1,2,4,5-Tetrachlorobenzene
 U208 1,1,1,2-Tetrachloroethane
 U209 1,1,2,2-Tetrachloroethane
 U210 Tetrachloroethylene
 See F027 2,3,4,6-Tetrachlorophenol

Appendix II - Toxic Chemicals

U LIST

Hazardous TOXIC CHEMICALS

Waste No. Substance

U394	A2213.
U001	Acetaldehyde (I)
U034	Acetaldehyde, trichloro
U 187	Acetamide, N-(4-ethoxyphenyl)
U005	Acetamide, N-9H-fluoren-2-yl
U240	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
U112	Acetic acid ethyl ester (I)
U144	Acetic acid, lead(2+) salt
U214	Acetic acid, thallium(1+) salt
See F027	Acetic acid, (2,4,5-trichlorophenoxy)
U002	Acetone (I)
U003	Acetonitrile (I,T)
U004	Acetophenone
U005	2-Acetylaminofluorene
U006	Acetyl chloride (C,R,T)
U008	Acrylic acid (I)
U009	Acrylonitrile
U011	Amitrole
U012	Aniline (I,T)
U136	Arsinic acid, dimethyl
U014	Auramine
U015	Azaserine
U010	Azido[2',3'=3,4]pyrrolo[1,2-a]indole-4,7-dione-6-amino-8-[[aminocarbonyl]oxy]methyl]-i,ta,2
U280	Barban.
U278	Bendiocarb.
U364	Bendiocarb phenol
U271	Benomyl.
U157	Benzf]aceanthrylene, 1,2-dihydro-3-methyl
U016	Benz[c]acridine
U017	Benzal chloride
U192	Benzamide, 3,5-dichloro-N-(i,t-dimethyl-2-propynyl)
U018	Benz[a]anthracene
U094	Benz[a]anthracene, 7,12-dimethyl

U012	Benzenamine(I,T)
U014	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl
U049	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U093	Benzenamine, N,N-dimethyl-4-(phenylazo)
U328	Benzenamine, 2-methyl
U353	Benzenamine, 4-methyl
U158	Benzenamine, 4,4'-methylenebis[2-chloro
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro
U019	Benzene (I,T)
U038	Benzenecetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester
U030	Benzene, 1-bromo-4-phenoxy
U035	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]
U037	Benzene, chloro
U221	Benzenediamine, ar-methyl
U028	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U069	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	1,2-Benzenedicarboxylic acid, diethyl ester
U102	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	1,2-Benzenedicarboxylic acid, dioctyl ester
U070	Benzene, 1,2-dichloro
U071	Benzene, 1,3-dichloro
U072	Benzene, 1,4-dichloro
U060	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro
U017	Benzene, (dichloromethyl)
U223	Benzene, 1,3-diisocyanatomethyl- (R,T)
U239	Benzene, dimethyl- (I,T)
U201	1,3-Benzenediol
U127	Benzene, hexachloro
U056	Benzene, hexahydro-(I)
U220	Benzene, methyl
U105	Benzene, 1-methyl-2,4-dinitro
U106	Benzene, 2-methyl-1,3-dinitro
U055	Benzene, (1-methylethyl)- (1)
U169	Benzene, nitro
U1B3	Benzene, pentachloro
U185	Benzene, pentachloronitro
U020	Benzenesulfonic acid chloride (C,R)

U020	Benzenesulfonyl chloride (C,R)
U207	Benzene, 1,2,4,5-tetrachloro
U061	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro
U247	Benzene, 1,1'-(2,2,2-tetrachloroethylidene)bis[4-methoxy
U023	Benzene, (trichloromethyl)
U234	Benzene, 1,3,5-trinitro
U021	Benzidine
U202	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts
U278	1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate.
U364	1,3-Benzodioxol-4-ol, 2,2-dimethyl-,
U203	1,3-Benzodioxole, 5-(2-propenyl)
U141	1,3-Benzodioxole, 5-(1-propenyl)
U367	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl
U090	1,3-Benzodioxole, 5-propyl
U064	Benzo[rs]t]pentaphene
U248	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl-butyl), & salts, when present at concentration
U022	Benzo[a]pyrene
U197	p-Benzoquinone
U023	Benzotrichloride (C,R,T)
U085	2,2'-Bioxirane
U021	[1,1'-Biphenyl]-4,4'-diamine
U073	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro
U091	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy
U095	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U225	Bromoform
U030	4-Bromophenyl phenyl ether
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro
U172	1-Butanamine, N-butyl-N-nitroso
U031	1-Butanol (I)
U159	2-Butanone (I,T)
U160	2-Butanone, peroxide (R,T)
U053	2-Butenal
U074	2-Butene, 1,4-dichloro- (I,T)
U143	2-Butenoic acid, 2-methyl-, 7-[[[2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]-
	2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester,
U031	n-Butyl alcohol (I)
U136	Cacodylic acid
U032	Calcium chromate

U372	Carbamic acid, 1H-benzimidazol-2-yl, methyl ester.
U271	Carbamic acid, [1[(butylamino)carbonyl]-1H-benzimidazol-2-yl]-, methyl ester.
U280	Carbamic acid, (3-chlorophenyl)-, 4-chloro-2-butynyl ester.
U238	Carbamic acid, ethyl ester
U178	Carbamic acid, methylnitroso-, ethyl ester
U373	Carbamic acid, phenyl-, 1-methylethyl ester
U409	Carbamic acid, [1,2-phenylenebis (iminocarbonothioyl)]bis-, dimethyl ester
U097	Carbamic chloride, dimethyl
U389	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3,3-trichloro-2-propenyl) ester
U387	Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester
U114	Carbamodithioic acid, 1,2-ethanediybis-,
U062	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester
U279	Carbaryl
U372	Carbendazim
U367	Carbofuran phenol
U215	Carbonic acid, dithallium(1+) salt
U033	Carbonic difluoride
U156	Carbonochloridic acid, methyl ester (I,T)
U033	Carbon oxyfluodde (R,T)
U211	Carbon tetrachloride
U034	Chloral
U035	Chlorambucil
U036	Chlordane, alpha & gamma isomers
U026	Chlornaphazin
U037	Chlorobenzene
U038	Chlorobenzilate
U039	p-Chloro-m-cresol
U042	2-Chloroethyl vinyl ether
U044	Chloroform
U046	Chloromethyl methyl ether
U047	beta-Chloronaphthalene
U048	o-Chlorophenol
U049	4-Chloro-o-toluidine, hydrochloride
U032	Chromic acid H ₂ CrO ₄ , calcium salt
U050	Chrysene
U051 ..	Creosote
U052	Cresol (Cresylic acid)
U053	Crotonaldehyde

U055	Cumene (I)
U246	Cyanogen bromide (CN)Br
U197	2,5-Cyclohexadiene-1,4dione
U056	Cyclohexane (I)
U129	Cyclohexane, 1,2,3,4,5,6-hexachloro-,
U057	Cyclohexanone (I)
U130	1,3-Cyclopentadiene,1,2,3,3,5,5-hexachloro-
U058	Cyclophosphamide
U240	2,4-D, salts & esters
U059	Daunomycin
U060	DDD
U061	DDT
U062	Diallate
U063	Dibenz[a,h]anthracene
U064	Dibenzo[a,i]pyrene
U066	1,2-Dibromo-3-chloropropane
U069	Dibutyl phthalate
U070	o-Dichlorobenzene
U071	m-Dichlorobenzene
U072	p-Dichlorobenzene
U073	3,3'-Dichlorobenzidine
U074	1,4-Dichloro-2-butene (I,T)
u075	Dichlorodifluoromethane
U078	1,1-Dichloroethylene
u079	1,2-Dichloroethylene
U025	Dichloroethyl ether
U027	Dichloroisopropyl ether
U024	Dichloromethoxy ethane
U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol
U084	1,3-Dichloropropene
U085	1,2:3,4-Diepoxybutane (I,T)
U108	1,4-Diethyleneoxide
U028	Diethylhexyl phthalate
U395	Diethylene glycol, dicarbamate.
U086	N,N'-Diethylhydrazine
U087	O,O-Diethyl S-methyl dithiophosphate
U088	Diethyl phthalate

U089	Diethylstilbesterol
U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine
U092	Dimethylamine (I)
U093	p-Dimethylaminoazobenzene
U094	7,12-Dimethylbenz[a]anthracen
U095	3,3'-Dimethylbenzidine
U096	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U097	Dimethylcarbamoyl chloride
U098	1,1-Dimethylhydrazine
U099	1,2-Dimethylhydrazine
U101	2,4-Dimethylphenol
U102	Dimethyl phthalate
U103	Dimethyl sulfate
U105	2,4-Dinitrotoluene
U106	2,6-Dinitrotoluene
U107	Di-n-octyl phthalate
U108	1,4-Dioxane
U109	1,2-Diphenylhydrazine
U110	Dipropylamine (I)
U111	Di-n-propylnitrosamine
U041	Epichlorohydrin
U001	Ethanal (1)
U404	Ethanamine, N,N-diethyl
U174	Ethanamine, N-ethyl-N-nitroso-
U155	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)
U067	Ethane, 1,2-dibromo-
U076	Ethane, 1,1-dichloro
U077	Ethane, 1,2-dichloro
U131	Ethane, hexachloro
U024	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro
U117	Ethane, 1,1'-oxybis-(I)
U025	Ethane, 1,1'-oxybis[2-chloro
U184	Ethane, pentachloro
U208	Ethane, 1,1,1,2-tetrachloro
U209	Ethane, 1,1,2,2-tetrachloro
U218	Ethanethioamide
U226	Ethane, 1,1,1-trichloro

U227	Ethane, 1,1,2-trichloro-
U410	Ethanimidolhoic acid, N,N' [thiobis[(methylimino)carbonyloxy]]bis-, dimethyl ester
U394	Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2-oxo-, methyl ester.
U359	Ethanol, 2-ethoxy
U173	Ethanol, 2,2'-(nitrosoimino)bis
U395	Ethanol, 2,2'-oxybis-, dicarbamate.
U004	Ethanone, 1-phenyl
U043	Ethene, chloro
U042	Ethane, (2-chloroethoxyr
U078	Ethene, 1,1-dichloro
U079	Ethene, 1,2-dichloro-, (E)
U210	Ethene, tetrachloro
U228	Ethane, trichloro
U112	Ethyl acetate (I)
U113	Ethyl acrylate (I)
U238	Ethyl carbamate (urethane)
U117	Ethyl ether (I)
U114	Ethylenebisdithiorarbamic acid, salts 8 esters
U067	Ethylene dibromide
U077	Ethylene dichloride
U359	Ethylene glycol monoethyl ether
U115	Ethylene oxide (I,T)
U116	Ethylenethiourea
U076	Ethylidene dichloride
U118	Ethyl methacrylate
U119	Ethyl methanesulfonate
U120	Fluoranthene
U122	Formaldehyde
U123	Formic acid (C,T)
U124	Furan (I)
U125	2-Furancarboxaldehyde (I)
U147	2,5-Furandione
U213	Furan, tetrahydro-(I)
U125	Furfural (I)
U124	Furfuran (I)
U206	Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-, D
U206	D-Glucose, 2-deoxy-2-[[[(methylnitrosoamino)
U126	Glycidylaldehyde

U163	Guanidine, N-methyl-N'-nitro-N-nitroso
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U130	Hexachlorocyclopentadiene
U131	Hexachloroethane
U132	Hexachlorophene
U243	Hexachloropropene
U133	Hydrazine (R,T)
U086	Hydrazine,1,2-diethyl-
U098	Hydrazine, 1,1-dimethyl
U099	Hydrazine, 1,2-dimethyl
U109	Hydrazine, 1,2-diphenyl
U134	Hydrofluoric acid (C,T)
U134	Hydrogen fluoride (C,T)
U096	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U116	2-Imidazolidinethione
U137	Indeno[1,2,3-cd]pyrene
U190	1,3-Isobenzofurandione
U140	Isobutyl alcohol (I,T)
U141	Isosafrole
U142	Kepone
U143	Lasiocarpine
U144	Lead acetate
U146	Lead, bis(acetato-0)tetrahydroxytri
U145	Lead phosphate
U146	Lead subacetate
U129	Lindane
U163	MNNG
U147	Maleic anhydride
U148	Maleic hydrazide
U149	Malononitrde/
U150	Melphalan /
U152	Methacrylonitrile (I, T)
U092	Methanamine, N-methyl- (1)
U029	Methane, bromo
U045	Methane, chloro- (I, T)
U046	Methane, chloromethoxy-
U068	Methane, dibromo

U080	Methane, dichloro
U075	Methane, dichlorodifluoro
U138	Methane, iodo
U119	Methanesulfonic acid, ethyl ester
U211	Methane, tetrachloro
U153	Methanethiol (I, T)
U225	Methane, tribromo
U044	Methane, trichloro
U121	Methane, trichlorofluoro-
U036	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7-a-hexahydro
U154	Methanol (I)
U155	Methapyrilene
U142	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,ta,3,3a,4,5,5,5a,5b,6-decachlorooctahydro
U247	Methoxychlor
U154	Methyl alcohol (1)
U029	Methyl bromide
U186	1-Methylbutadiene (I)
U045	Methyl chloride (I,T)
U156	Methyl chlorocarbonate (I,T)
U226	Methyl chloroform
U157	3-Methylcholanthrene
U158	4,4'-Methylenebis(2-chloroaniline)
U068	Methylene bromide
U080	Methylene chloride
U159	Methyl ethyl ketone (MEK) (I,T)
U160	Methyl ethyl ketone peroxide (R,T)
U138	Methyl iodide
U161	Methyl isobutyl ketone (1)
U162	Methyl methacrylate (I,T)
U161	4-Methyl-2-pentanone (I)
U164	Methylthiouracil
U010	Mitomycin C
U059	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-t-ddeoxy)-alpha-L-lyxo-hexopyranosyl]oxy
U167	1-Naphthalenamine
U168	2-Naphthalenamine
U026	Naphthalenamine, N,N'-bis(2-chloroethyl)
U165	Naphthalene
U047	Naphthalene, 2-chloro

U166	1,4-Naphthalenedione
U236	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'
U279	1-Naphthalenol, methylcarbamate.
U166	1,4-Naphthoquinone
U167	alpha-Naphthylamine
U168	beta-Naphthylamine
U217	Nitric acid, thallium(1+) salt
U169	Nitrobenzene (I,T)
U170	p-Nitrophenol
U171	2-Nitropropane (I,T)
U172	N-Nitrosodi-n-butylamine
U173	N-Nitrosodiethanolamine
U174	N-Nitrosodiethylamine
U176	N-Nitroso-N-ethylurea
U177	N-Nitroso-N-methylurea
U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine
U180	N-Nitrosopymolidine
U181	5-Nitro-o-toluidine
U193	1,2-Oxathiolane, 2,2-dioxide
U058	2H-1,3,2-Oxazaphosphorin-2-amine,N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide
U115	Oxirane (I,T)
U126	Oxiranecarboxyaldehyde
U041	Oxirane, (chloromethyl)
U212	Paraldehyde
U183	Pentachlorobenzene
U184	Pentachloroethane
U185	Pentachloronitrobenzene (PCNB)
See F027	Pentachlorophenol
U161	Pentanol, 4-methyl
U186	1,3-Pentads ne (I)
U187	Phenace6
U048	Phenol, 2-chloro
U039	Phenol, 4-chloro-3-methyl
U081	Phenol, 2,4-dichloro
U082	Phenol, 2,6-dichloro
U089	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis-, (E)
U101	Phenol, 2,4-dimethyl

U052 Phenol, methyl
 U132 Phenol, 2,2'-methylenebis[3,4,6-trichloro
 U411 Phenol, 2-(1-methylethoxy)-, methylcarbamate.
 U170 Phenol, 4-nitro-
 See F027 Phenol, pentachloro
 See F027 Phenol, 2,3,4,6-tetrachloro
 See F027 Phenol, 2,4,5-trichloro
 U150 L-Phenylalanine, 4-[bis(2-chloroethyl)amino]
 U145 Phosphoric acid, lead(2+) salt (2:3)
 U087 Phosphorodithioic acid, 0,0-diethyl S-methyl ester
 U189 Phosphorus sulfide (R)
 U190 Phthalic anhydride
 U191 2-Picoline
 U179 Piperidine, 1-nitroso
 U192 Pronamide
 U194 1-Propanamine (I,T)
 U111 1-Propanamine, N-nitroso-N-propyl
 U110 1-Propanamine, N-propyl- (I)
 U066 Propane, 1,2-dibromo-3-chloro
 U083 Propane, 1,2-dichloro
 U149 Propanedinitrile
 U171 Propane, 2-nitro- (I,T)
 U027 Propane, 2,2'-oxybis[2-chloro
 U193 1,3-Propane sultone
 See F027 Propanoic acid, 2-(2,4,5-trichlorophenoxy)
 U235 1-Propanol, 2,3-dibromo-, phosphate (3:1)
 U140 1-Propanol, 2-methyl- (I,T)
 U002 2-Propanone (I)
 U007 2-Propenamide
 u084 1-Propene, 1,3-dichloro
 U243 1-Propene, 1,1,2,3,3,3-hexachloro
 U009 2-Propenenitrile
 U152 2-Propenenitrile, 2-methyl- (I,T)
 U008 2-Propenoic acid (I)
 U113 2-Propenoic acid, ethyl ester (I)
 U118 2-Propenoic acid, 2-methyl-, ethyl ester
 U162 2-Propenoic acid, 2-methyl-, methyl ester (I,T)
 U373 Propham.

U411	Propoxur.
U387	Prosulfocarb.
U194	n-Propylamine (I,T)
U083	Propylene dichloride
U148	3,6-Pyridazinedione, 1,2-dihydro-
U196	Pyridine
U191	Pyridine, 2-methyl
U237	2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2chloroethyl)amino]-
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	Pyrrolidine, 1-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Saccharin, & salts
U203	Safrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium sulfide
U205	Selenium sulfide SeS_2 (R,T)
U015	L-Serine, diazoacetate (ester)
See F027	Silvex (2,4,5-TP)
U206	Streptozolocin
U103	Sulfuric acid, dimethyl ester
U213	Tetrahydrofuran (I)
U214	Thallium(I) acetate
U215	Thallium(I) carbonate
U216	Thallium(I) chloride
U216	Thallium chloride TlCl
U217	Thallium(I) nitrate
U218	Thioacetamide
U410	Thiodicarb.
U153	Thiomethanol (I,T)
U244	Thioperoxydicarbonic diamide $[(\text{H}: \text{N})\text{C}(\text{S})]_z \text{S}_2$, tetramethyl
U409	Thiophanate-methyl.
U219	Thiourea
U244	Thiram
U220	Toluene
U221	Toluenediamine
U223	Toluene diisocyanate (R,T)

U328	o-Toluidine
U353	p-Toluidine
U222	o-Toluidine hydrochloride
U389	Triallate.
U011	1 H-1,2,4-Triazol-3-amine
U408	2,4,6-Tribromophenol.
U227	1,1,2-Trichloroethane
U228	Trichloroethylene
U121	Trichloromonofluoromethane
See F027	2,4,6-Trichlorophenol
See F027	2,4,6-Trichlorophenol
U404	Triethylamine.
U234	1,3,5-Trinitrobenzene (R,T)
U182	1,3,5-Trioxane, 2,4,6-trimethyl
U235	Tris(2,3-dibromopropyl) phosphate
U236	Trypan blue
U237	Uracil mustard
U176	Urea, N-ethyl-N-nitroso
U177	Urea, N-methyl-N-nitroso
U043	Vinyl chloride
U248	Warfarin, & salts, when present at concentrations of 0.3% or less
U239	Xylene (1)
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester
U249	Zinc phosphide Zn ₃ P ₂ , when present at concentrations of 10 % or less

Appendix II

Highly hazardous chemicals, toxics, reactives; Highly flammable chemicals (NFPA #4); peroxidizable; and shock sensitive substances

Highly Hazardous Chemicals - Toxics and Reactives

Acetaldehyde	Ethylamine
Acrolein (2-propenal)	Ethylene Fluorohydrin
Acrylyl Chloride	Ethylene Oxide
Allyl Chloride	Ethyleneimine
Allylamine	Flourine
Alkylaluminums	Formaldehyde (Formalin)
Ammonia, Anhydrous	Furan
Ammonia, solutions > 44% by weight	Hexaflouroacetone
Ammonium Perchlorate	Hydrochloric Acid (anhydrous)
Ammonium Permanganate	Hydroflouric Acid (anhydrous)
Arsine (Arsenic Hydride)	Hydrogen Bromide
Bis (Chloromethyl) Ether	Hydrogen Chloride
Boron Trichloride	Hydrogen Cyanide(anhydrous)
Bromine	Hydrogen Flouride
Chlorodiethylaluminum (Diethylaluminum Chloride)	Dichloro Acetylene
1-Chloro-2,4-Dinitrobenzene	Dichlorosilane
Chloromethyl Methyl Ether	Diethylzinc
Chloropicrin	Diisopropyl Peroxydicarbonate
Chloropicrin and Methyl Bromide Mixture	Dilauroyl Peroxide
Chloropicrin and Methyl Chloride Mixture	Dimethyldichlorosilane
Commune Hydroperoxide	Dimethylhydrazine, 1,1
Cyanogen	Dimethylamine (anhydrous)
Cyanogen Chloride	2,4-Dinitroaniline
Cyanuric Flouride	Ethyl Methyl Ketone Peroxide
Diacetyl Peroxide (>70%)	Methyl Ethyl Ketone
Diazomethane	Peroxide (>60%)
Dibenzoyl Peroxide	Methyl Flouroacetate
Diborane	Methyl Flourosulfate
Dibutyl Peroxide	Methyl Hydrazine
Bromine Chloride	Methyl iodide
Bromine Pentaflouride	Methyl Isocyanate
Bromine Triflouride	Methyl Mercaptan
3-Bromopropyne (Propargyl Bromide)	Methyl Vinyl Ketone
Butyl Hydroperoxide (tert.) Butyl Perbenzoate (tert.)	Methyltrichlorosilane
Carbonyl Chloride	Nickel Carbonyl (Nickel Tetracarbonyl)
Carbonyl Flouride	Nitric Acid (> 94.5% by weight)
Cellulose Nitrate (>12.6% nitrogen)	Nitric Oxide

Chlorine	Nitroaniline (para Nitroaniline)
Chlorine Dioxide	Nitromethane
Chlorine Pentafluoride	Nitrogen Dioxide
Chlorine Trifluoride	Hydrogen Peroxide
Ethyl Nitrite	Hydrogen Selenide
Hydrogen Sulfide	Nitrogen Trioxide
Hydroxylamine	Oleum (65-80% by weight) (Fuming Sulfuric Acid)
Iron, Pentacarbonyl	Osmium Tetroxide
Isopropylamine	Oxygen Difluoride (Fluorine Monoxide)
Ketene	Ozone
Methacrylaldehyde	Pentaborane
Methacryloyl Chloride	Peracetic Acid (>60% Acetic Acid) (Peroxyacetic Acid)
Methacryloylxyethyl Isocyanate	Perchloric Acid (>60% by weight)
Methyl Acrylonitrile	Perchloromethyl Mercaptan
Methylamine (anhydrous)	Stibine (Antimony Hydride)
Methyl Bromide	Sulfur Dioxide (liquid)
Methyl Chloride	Sulfur Pentafluoride
Methyl Chloroformate	Sulfur Tetrafluoride
Perchloryl Fluoride	Sulfur Trioxide (Sulfuric Anhydride)
Peroxyacetic Acid (>60% Acetic Acid)	Tellurium Hexafluoride
Phosgene (Carbonyl Chloride)	Tetrafluoroethylene
Phosphine (Hydrogen Phosphide)	Tetrafluorohydrazine
Phosphorus Oxychloride (Phosphoryl Chloride)	Tetramethyl Lead
Phosphorus Trichloride	Thionyl Chloride
Phosphoryl Chloride	Trichloro (chloromethyl) Silane
Propargyl Bromide	Trichloro (dichlorophenyl) Silane
Propyl Nitrate	Trichlorosilane
Sarin	Trifluorochloroethylene
Selenium Hexafluoride	Trimethoxysilane
Nitrogen Oxides (NO;NO ₂ ;N ₂ O ₄ ;N ₂ O ₃)	
Nitrogen Tetroxide (Nitrogen Peroxide)	

Highly Flammable Materials (NFPA #4)

Acetaldehyde
Acetylene
Butane
1-Butene
Calcium Carbide
Carbon Monoxide
Chlorine Monoxide
Cyanogen
Cyclobutane
Cyclopropane
Deuterium
Dibenzoyl Peroxide
Dibromane
1,1-Dichloroethene
Dichlorosilane
Dimethylamine
Dimethyl Sulfide
Ethane
Ethylamine
Ethyl Chloride
Ethylene
Ethylene Oxide
Ethyl Ether
Propane
Propylene
Furan
Gas, Natural
Hydrocyanic Acid (96%)
Hydrogen
Hydrogen Sulfide

Peroxidizable

Acetal
Cumene
Cyclohexane
Cyclooctene
Decahydronaphthalene
Decalin
Diacetylene
Dicyclopentadiene

Diethyl Ether

Isobutane
Isopentane
Isoprene
Isopropyl Chloride
Lithium Hydride
Methane
Methelamine
Methyl Chloride
Methyl Ether
Methyl Ethyl Ether
Methyl Formate
Methyl Mercaptan
Pentane
1-Pentane
Petroleum Ether
Phosphine
Picric Acid
Trinitrotoluene (TNT)
Vinyl Chloride
Propylene Oxide
Propyl Nitrate
Silane
Tetrafluoroethylene
Trichlorosilane
Trimethylamine
Vinyl Ethyl Ether
Vinyl Fluoride
Vinylidene Chloride
Vinylidene Fluoride
Vinyl Methyl Ether

Divinyl Acetylene
Ethyl Ether
Ethylene Glycol Dimethyl
Ether (glyme)
Methyl Acetylene
Tetrahydrofuran
Tetrahydronaphthalene (tetralin)
Vinyl Acetate

Vinyl Ethers
Vinylidene Chloride

Shock Sensitive Materials

Acetylides
Aluminum Ophorite Explosive
Amatol
Ammonal
Ammonium Nitrate
Ammonium Perchlorate
Ammonium pPicrate
Ammonium salt lattice
Butyl Tetryl
Calcium Nitrate
Copper Acetylide
Dinitrophenyl Hydrazine
Dinitrotoluene
Dipicryl Sulfone
Dipicrylamine
Erythritol Tetranitrate
Fulminate of Silver
Fulminate of Gold
Fulminating Mercury
Fulminating Platinum
Gelatinized Nitrocellulose
Cyanuric Triazide
Cylcotrimethylenetrinitramine
Dinitroethyleneurea
Dinitroglycerine
Dinitrophenol
Dinitrophenolates
Hexanite
Hexanitrodiphenylamine
Hexanitrostilbene
Hexogen
Hydrazine Mixtures
Hydrazinium Nitrate
Hydrazoic Acid
Lead Azide
Lead Mannite
Lead Mononitroresorcinat
Lead Picrate
Lead Salts
Lead Styphnate
Magnesium Ophorite
Mannitol Hexanitrate
Mercury Oxalate
Mercury Tartrate
Nitrated Carbohydrate

Nitrated Polyhydric Alcohol
Nitrogen Trichloride
Nitrogen Tri-Iodide
Nitroglycerin
Nitroglyceride
Nitroglycol
Nitroguanidine
Nitroparaffins
Nitronium Perchlorate
Nitrotoluene
Nitrourea
Guanyl Nitrosamino Guanyltetrazene
Guanyl Nitrosamino Guanylidene
Guanylidene
Heavy Metal Azides
Organic Amine Nitrates
Organic Nitramines
Organic Peroxides (t-Butyl Peroxide)
Picramic Acid
Picramide
Picric Acid
Picryl Chloride
Picryl Flouride
Polynitro Aliphatic Compounds
Potassium Nitroaminotetrazole
Silver Acetylide
Silver Azide
Silver Styphnate
Silver Tetrazene
Sodatol
Sodium Amatol
Sodium Dinitro-ortho-cresolate
Sodium/Potassium Nitrate explosive m
Sodium Picramate
Syphnic Acid
Tetrazene
Tetranitrocarbazole
Tetrytol
Trinitroanisole
Trinitrobenzene
Trimonite
Trinitronaphthalene
Trinitrophenetol
Tritonal
Urea Nitrate

Nitrated Glucoside

TrinitroToluene (TNT)

Reporoductive Hazards, Teratogenic and Mutagenic Chemcials and Drugs

Acetohydroxamic acid

Actinomycin D

All-trans retinoic acid

Alprazolam

Amikacin sulfate

Aminoglutethimide

Aminoglycosides

Aminopterin

Androgenic Hormones

Angiotensin converting enzyme (ACE) inhibitors

Anisindione

Aspirin

Azathioprine

Barbiturates

Benomyl

Benzene

Benzphetamine hydrochloride

Benzodiazepines

Bischloroethyl nitrosourea (BCNU) (Carmustine)

Bromoxynil

Busulfan

Butabarbital sodium

1,4-Butanediol dimethylsulfonate (Busulfan)

Calcium Arsenate

Carbon disulfide

Carbon monoxide

Carboplatin

Chenodiol

Chlorcyclizine hydrochloride

Chlorambucil

Chlorobiphenyls

Chlordecone (Kepone)

Chlordiazepoxide

Chlordiazepoxide hydrochloride

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) Lomustine)

Cladribine

Clomiphene citrate

Clorazepate dipotassium

Cocaine

Colchicine

Conjugated estrogens

Coumarin Anticoagulants

Cyhexatin

Cytarabine

Danazol

Daunorubicin hydrochloride

Demeclocycline hydrochloride (inte

Diazepam

Dicumarol

Diethylstilbestrol (DES)

Dimethylmercury

Dinitrogen pentoxide

Dinocap

Dinoseb

Diphenylhydantoin (Phenytoin)

Doxycycline (internal use)

Doxycycline calcium (internal use)

Doxycycline hyclate (internal use)

Doxycycline monohydrate (internal

Ergotamine tartrate

Ethidium Bromide

Ethyl alcohol in alcoholic beverages

Ethylene glycol monoethyl ether

Ethylene glycol monomethyl ether

Ethylene glycol monoethyl ether ac

Ethylene glycol monomethyl ether a

Ethylene thiourea

Etoposide

Etretinate

Fluorouracil

Fluoxymesterone

Flurazepam hydrochloride

Flutamide

Halazepam

Halothane

Hexachlorobenzene

Ifosfamide

Isotretinoin

Lead

Lithium

Lithium carbonate

Lithium citrate

Lorazepam

Lovastatin

Cyanazine	Medroxyprogesterone acetate
Cycloheximide	Megestrol acetate
Cyclophosphamide (anhydrous)	Melphalan
Cyclophosphamide (hydrated)	Menotropins
Mercaptopurine	Meprobamate
Mercury and mercury compounds	Polybrominated biphenyls
Methacycline hydrochloride	Polychlorinated biphenyls
Methimazole	Procarbazine hydrochloride
Methotrexate	Propylthiouracil
Methotrexate sodium	Retinol/retinyl esters
Methylaminopterin	When in daily dosages in excess
Methyl bromide as a structural fumigant	3,000 retinol equivalents. (NOTE
Methyl mercury	esters are required and essential
Methyltestosterone	normal reproductive function. The
Midazolam hydrochloride	daily level during pregnancy is 8,
Minocycline hydrochloride (internal use)	13-cis-retinoic acid
Misoprostol	Ribavirin
Mitoxantrone hydrochloride	Secobarbital sodium
Nafarelin acetate	Streptomycin sulfate
Neomycin sulfate (internal use)	Tamoxifen citrate
Netilmicin sulfate	Temazepam
Nickel carbonyl	Teniposide
Nicotine	Testosterone cypionate
Nitrogen mustard (Mechlorethamine)	Testosterone enanthate
Nitrogen mustard hydrochloride (Mechlorethamine -	2,3,7,8-Tetrachlorodibenzo-para-di
hydrochloride)	Tetracyclines (internal use)
Norethisterone (Norethindrone)	Tetracycline (internal use)
Norethisterone acetate (Norethindrone acetate)	Tetracycline hydrochloride (internal
Norethisterone (Norethindrone)/Ethinyl estradiol	Thalidomide
Norethisterone (Norethindrone)/Mestranol	Thioguanine
Norgestrel	Tobacco smoke (primary)
Oxazepam	Tobramycin sulfate
Oxytetracycline (internal use)	Toluene
Oxytetracycline hydrochloride (internal use)	Triazolam
Paramethadione	Trilostane
Penicillamine	Trimethadione
Pentobarbital sodium	Uracil mustard
Pentostatin	Urethane
Phenacemide	Urofollitropin
Phenprocoumon	Valproate (Valproic acid)
Pipobroman	Vinblastine sulfate
Plicamycin	Vincristine sulfate
	Warfarin

Reproductive Hazards - Infectious Agents

Cytomegavirus
Herpes Virus Hominis
Parvovirus B-19
Rubella Virus
Syphilis
Toxoplasmosis
Venezuelan Equine
Encephalitis Virus

Female reproductive toxicity

Aminopterin
Anabolic steroids
Aspirin
Carbon disulfide
Cocaine
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
Ethylene oxide
Lead
Tobacco smoke (primary)
Uracil mustard

Male reproductive toxicity

Anabolic steroids
Benomyl
Carbon disulfide
Colchicine
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
1,2-Dibromo-3-chloropropane (DBCP)
m-Dinitrobenzene
o-Dinitrobenzene
p-Dinitrobenzene
Dinoseb
Epichlorohydrin
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol monomethyl ether acetate
Hexamethylphosphoramide
Lead
Nitrofurantoin
Tobacco smoke (primary)
Uracil mustard

Potential Teratogenic Agents Currently Under Investigation

Acetone
Acetonitrile
Acrylamide
Arsine
Bendectin
Bisphenol A
Bromoacetonitrile
Bromochloroacetic Acid
Butyl Benzyl Phthalate

Dimethyl Phthalate
Diphenhydramine Hydrochloride
Dipropylene Glycol
Ethylene Chlorohydrin
Ethylene Glycol
Ethylene Glycol Diethyl Ether
Ethylene Glycol Monobutyl Ether
Ethylenediamine

d-Camphor
Carbon Disulfide
Chlordibromomethane
Chlorpromazine Hydrochloride
Codeine
Dibromoacetonitrile
Diethyl Phthalate
Diethylene Glycol
Diethylene Glycol Diethyl Ether
Diethylene Glycol Dimethyl Ether

Ethylene Oxide
Formamide
Gallium Arsenide
Gentian Violet (Hexamethyl-p-rosaniline Chloride)
Glyoxal Trimeric Dihydrate
Hexachloroacetone
Hexachloro-1,3-butadiene
Melatonin
Sodium Bromate
Tribromoacetic Acid

APPENDIX II

CONCENTRATIONS OF CHEMICALS IMMEDIATELY DANGEROUS TO LIFE OR HEALTH

**Documentation for Immediately Dangerous to Life or Health
Concentrations (IDLHs)****NIOSH CHEMICAL LISTING
AND DOCUMENTATION OF
REVISED IDLH VALUES
(AS OF 3/1/95)**

SUBSTANCE	ORIGINAL IDLH VALUE	REVISED IDLH VALUE
Acetaldehyde	10,000 ppm	2,000 ppm
Acetic acid	1,000 ppm	50 ppm
Acetic anhydride	1,000 ppm	200 ppm
Acetone	20,000 ppm	2,500 ppm [LEL]
Acetonitrile	4,000 ppm	500 ppm
Acetylene tetrabromide	10 ppm	8 ppm
Acrolein	5 ppm	2 ppm
Acrylamide	Unknown	60 mg/m ³
Acrylonitrile	500 ppm	85 ppm
Aldrin	100 mg/m ³	25 mg/m ³
Allyl alcohol	150 ppm	20 ppm
Allyl chloride	300 ppm	250 ppm
Allyl glycidyl ether	270 ppm	50 ppm
2 Aminopyridine	5 ppm	5 ppm [Unch]
Ammonia	500 ppm	300 ppm
Ammonium sulfamate	5,000 mg/m ³	1,500 mg/m ³
n-Amyl acetate	4,000 ppm	1,000 ppm
sec-Amyl acetate	9,000 ppm	1,000 ppm
Aniline	100 ppm	100 ppm [Unch]
o-Anisidine	50 mg/m ³	50 mg/m ³ [Unch]
p-Anisidine	50 mg/m ³	50 mg/m ³ [Unch]
Antimony compounds (as Sb)	80 mg Sb/m ³	50 mg Sb/m ³
ANTU	100 mg/m ³	100 mg/m ³ [Unch]
Arsenic (inorganic compounds, as As)	100 mg As/m ³	5 mg As/m ³
Arsine	6 ppm	3 ppm
Azinphosmethyl	20 mg/m ³	10 mg/m ³
Barium (soluble compounds, as Ba)	1,100 mg Ba/m ³	50 mg Ba/m ³ Ba/m ³
Benzene	3,000 ppm	500 ppm
Benzoyl peroxide	7,000 mg/m ³	1,500 mg/m ³

Benzyl chloride	10 ppm	10 ppm [Unch]
Beryllium compounds (as Be)	10 mg Be/m ³	4 mg Be/m ³
Boron oxide	N.E.	2,000 mg/m ³
Boron trifluoride	100 ppm	25 ppm
Bromine	10 ppm	3 ppm
Bromoform	Unknown	850 ppm
1,3-Butadiene	20,000 ppm [LEL]	2,000 ppm
[LEL]		
2-Butanone	3,000 ppm	3,000 ppm Unch]
2-Butoxyethanol	700 ppm	700 ppm [Unch]
n-Butyl acetate	10,000 ppm	1,700 ppm [LEL]
sec-Butyl acetate	10,000 ppm	1,700 ppm [LEL]
tert-Butyl acetate	10,000 ppm	1,500 ppm [LEL]
n-Butyl alcohol	8,000 ppm	1,400 ppm [LEL]
sec-Butyl alcohol	10,000 ppm	2,000 ppm
tert-Butyl alcohol	8,000 ppm	1,600 ppm
n-Butylamine	2,000 ppm	300 ppm
tert-Butyl chromate	30 mg/m ³ (asCrO ₃)	15 mgCr(VI)/m ³
n-Butyl glycidyl ether	3,500 ppm	250 ppm
n-Butyl mercaptan	2,500 ppm	500 ppm
p-tert-Butyltoluene	1,000 ppm	100 ppm
Cadmium dust (as Cd)	50 mg Cd/m ³	9 mg Cd/m ³
Cadmium fume (as Cd)	9 mg Cd/m ³	9 mgCd/m ³ [Unch]
Calcium arsenate (as As)	100 mg As/m ³	5 mg As/m ³
Calcium oxide	Unknown	25 mg/m ³
Camphor (synthetic)	200 mg/m ³	200 mg/m ³ [Unch]
Carbaryl	600 mg/m ³	100 mg/m ³
Carbon black	N.E.	1,750 mg/m ³
Carbon dioxide	50,000 ppm	40,000 ppm
Carbon disulfide	500 ppm	500 ppm [Unch]
Carbon monoxide	1,500 ppm	1,200 ppm
Carbon tetrachloride	300 ppm	200 ppm
Chlordane	500 mg/m ³	100 mg/m ³
Chlorinated camphene	200 mg/m ³	200 mg/m ³ [Unch]
Chlorinated diphenyl oxide	Unknown	5 mg/m ³
Chlorine	30 ppm	10 ppm
Chlorine dioxide	10 ppm	5 ppm
Chlorine trifluoride	20 ppm	20 ppm [Unch]
Chloroacetaldehyde	100 ppm	45 ppm
alpha-Chloroacetophenone	100 mg/m ³	15 mg/m ³
Chlorobenzene	2,400 ppm	1,000 ppm
o-Chlorobenzylidene malononitrile	2 mg/m ³	2 mg/m ³ [Unch]
Chlorobromomethane	5,000 ppm	2,000 ppm
Chlorodiphenyl (42% chlorine)	10 mg/m ³	5 mg/m ³

Chlorodiphenyl (54% chlorine)	5 mg/m ³	5 mg/m ³ [Unch]
Chloroform	1,000 ppm	500 ppm
1-Chloro-1-nitropropane	2,000 ppm	100 ppm
Chloropicrin	4 ppm	2 ppm
beta-Chloroprene	400 ppm	300 ppm
Chromic acid and chromates	30 mg/m ³ (asCrO ₃)	15 mg r(VI)/m ³
Chromium (II) compounds	[as Cr(II)]N.E.	250 mgcr(II)/m ³
Chromium (III) compounds	[as Cr(III)]N.E.	25 mgcr(III)/m ³
Chromium metal (as Cr)	N.E.	250 mg Cr/m ³
Coal tar pitch volatiles	700 mg/m ³	80 mg/m ³
Cobalt metal, dust and fume (as Co)	20 mg Co/m ³	20mg Co/m ³ [Unch]
Copper (dusts and mists, as Cu)	N.E.	100 mg Cu/m ³
Copper fume (as Cu)	N.E.	100 mg Cu/m ³
Cotton dust (raw)	N.E.	100 mg/m ³
Crag (r) herbicide	5,000 mg/m ³	500 mg/m ³
Cresol (o, m, p isomers)	250 ppm	250 ppm [Unch]
Crotonaldehyde	400 ppm	50 ppm
Cumene	8,000 ppm	900 ppm [LEL]
Cyanides (as CN)	50 mg/m ³ (as CN)	25 mg/m ³ (asCN)
Cyclohexane	10,000 ppm	1,300 ppm [LEL]
Cyclohexanol	3,500 ppm	400 ppm
Cyclohexanone	5,000 ppm	700 ppm
Cyclohexene	10,000 ppm	2,000 ppm
Cyclopentadiene	2,000 ppm	750 ppm
2,4-D	500 mg/m ³	100 mg/m ³
DDT	N.E.	500 mg/m ³
Decaborane	100 mg/m ³	15 mg/m ³
Demeton	20 mg/m ³	10 mg/m ³
Diacetone alcohol	2,100 ppm	1,800 ppm [LEL]
Diazomethane	2 ppm	2 ppm [Unch]
Diborane	40 ppm	15 ppm
Dibutyl phosphate	125 ppm	30 ppm
Dibutyl phthalate	9,300 mg/m ³	4,000 mg/m ³
o-Dichlorobenzene	1,000 ppm	200 ppm
p-Dichlorobenzene	1,000 ppm	150 ppm
Dichlorodifluoromethane	50,000 ppm	15,000 ppm
1,3-Dichloro 5, 5-dimethylhydantoin	Unknown	5 mg/m ³
1,1-Dichloroethane	4,000 ppm	3,000 ppm
1,2-Dichloroethylene	4,000 ppm	1,000 ppm
Dichloroethyl ether	250 ppm	100 ppm
Dichloromonofluoromethane	50,000 ppm	5,000 ppm
1,1-Dichloro 1-nitroethane	150 ppm	25 ppm
Dichlorotetrafluoroethane	50,000 ppm	15,000 ppm

Dichlorvos	200 mg/m3	100 mg/m3
Dieldrin	450 mg/m3	50 mg/m3
Diethylamine	2,000 ppm	200 ppm
2-Diethylaminoethanol	500 ppm	100 ppm
Difluorodibromomethane	2,500 ppm	2,000 ppm
Diglycidyl ether	25 ppm	10 ppm
Diisobutyl ketone	2,000 ppm	500 ppm
Diisopropylamine	1,000 ppm	200 ppm
Dimethyl acetamide	400 ppm	300 ppm
Dimethylamine	2,000 ppm	500 ppm
N,N-Dimethylaniline	100 ppm	100 ppm [Unch]
Dimethyl 1,2-dibromo 2,2-dichlorethyl phosphate	1,800 mg/m3	200 mg/m3
Dimethylformamide	3,500 ppm	500 ppm
1,1-Dimethylhydrazine	50 ppm	15 ppm
Dimethylphthalate	9,300 mg/m3	2,000 mg/m3
Dimethyl sulfate	10 ppm	7 ppm
Dinitrobenzene (o, m, p isomers)	200 mg/m3	50 mg/m3
Dinitroocresol	5 mg/m3	5 mg/m3 [Unch]
Dinitrotoluene	200 mg/m3	50 mg/m3
Di sec-octyl phthalate	Unknown	5,000 mg/m3
Dioxane	2,000 ppm	500 ppm
Diphenyl	300 mg/m3	100 mg/m3
Dipropylene glycol methyl ether	Unknown	600 ppm
Endrin	2,000 mg/m3	2 mg/m3
Epichlorohydrin	250 ppm	75 ppm
EPN	50 mg/m3	5 mg/m3
Ethanolamine	1,000 ppm	30 ppm
2-Ethoxyethanol	6,000 ppm	500 ppm
2-Ethoxyethyl acetate	2,500 ppm	500 ppm
Ethyl acetate	10,000 ppm	2,000 ppm [LEL]
Ethyl acrylate	2,000 ppm	300 ppm
Ethyl alcohol	15,000 ppm	3,300 ppm [LEL]
Ethylamine	4,000 ppm	600 ppm
Ethyl benzene	2,000 ppm	800 ppm [LEL]
Ethyl bromide	3,500 ppm	2,000 ppm
Ethyl butyl ketone	3,000 ppm	1,000 ppm
Ethyl chloride	20,000 ppm	3,800 ppm [LEL]
Ethylene chlorohydrin	10 ppm	7 ppm
Ethylenediamine	2,000 ppm	1,000 ppm
Ethylene dibromide	400 ppm	100 ppm
Ethylene dichloride	1,000 ppm	50 ppm
Ethylene glycol dinitrate	500 mg/m3	75 mg/m3
Ethyleneimine	100 ppm	100 ppm [Unch]

Ethylene oxide	800 ppm	800 ppm
[Unch]		
Ethyl ether	19,000 ppm[LEL]	1,900 ppm
[LEL]		
Ethyl formate	8,000 ppm	1,500 ppm
Ethyl mercaptan	2,500 ppm	500 ppm
N-Ethylmorpholine	2,000 ppm	100 ppm
Ethyl silicate	1,000 ppm	700 ppm
Ferbam	N.E.	800 mg/m3
Ferrovandium dust	N.E.	500 mg/m3
Fluorides (as F)	500 mg F/m3	250 mg
F/m3		
Fluorine	25 ppm	25 ppm
[Unch]		
Fluorotrichloromethane	10,000 ppm	2,000 ppm
Formaldehyde	30 ppm	20 ppm
Formic acid	30 ppm	30 ppm
[Unch]		
Furfural	250 ppm	100 ppm
Furfuryl alcohol	250 ppm	75 ppm
Glycidol	500 ppm	150 ppm
Graphite (natural)	N.E.	1,250
mg/m3		
Hafnium compounds (as Hf)	Unknown	50 mg
Hf/m3		
Heptachlor	700 mg/m3	35 mg/m3
n-Heptane	5,000 ppm	750 ppm
Hexachloroethane	300 ppm	300 ppm
[Unch]		
Hexachloronaphthalene	2 mg/m3	2 mg/m3
[Unch]		
n-Hexane	5,000 ppm	1,100 ppm
[LEL]		
2-Hexanone	5,000 ppm	1,600 ppm
Hexone	3,000 ppm	500 ppm
sec Hexyl acetate	4,000 ppm	500 ppm
Hydrazine	80 ppm	50 ppm
Hydrogen bromide	50 ppm	30 ppm
Hydrogen chloride	100 ppm	50 ppm
Hydrogen cyanide	50 ppm	50 ppm
[Unch]		
Hydrogen fluoride (as F)	30 ppm	30 ppm
[Unch]		
Hydrogen peroxide	75 ppm	75 ppm [Unch]

Hydrogen selenide (as Se)	2 ppm	1 ppm
Hydrogen sulfide	300 ppm	100 ppm
Hydroquinone	Unknown	50 mg/m3
Iodine	10 ppm	2 ppm
Iron oxide dust and fume (as Fe) N.E.		2,500 mg Fe/m3
Isoamyl acetate	3,000 ppm	1,000 ppm
Isoamyl alcohol (primary and secondary)	10,000 ppm	500 ppm
Isobutyl acetate	7,500 ppm	1,300 ppm [LEL]
Isobutyl alcohol	8,000 ppm	1,600 ppm
Isophorone	800 ppm	200 ppm
Isopropyl acetate	16,000 ppm	1,800 ppm
Isopropyl alcohol	12,000 ppm	2,000 ppm [LEL]
Isopropylamine	4,000 ppm	750 ppm
Isopropyl ether	10,000 ppm	1,400 ppm [LEL]
Isopropyl glycidyl ether	1,000 ppm	400 ppm
Ketene	Unknown	5 ppm
Lead compounds (as Pb)	700 mg Pb/m3	100 mg Pb/m3
Lindane	1,000 mg/m3	50 mg/m3
Lithium hydride	55 mg/m3	0.5 mg/m3
L.P.G. [LEL]	19,000 ppm[LEL]	2,000 ppm
Magnesium oxide fume	N.E.	750 mg/m3
Malathion	5,000 mg/m3	250 mg/m3
Maleic anhydride	Unknown	10 mg/m3
Manganese compounds (as Mn)	N.E.	500 mg Mn/m3
Mercury compounds [except (organo) alkyls as Hg]	28 mg Hg/m3	10 mg Hg/m3
Mercury (organo) alkyl compounds(as Hg)	10 mg Hg/m3	2 mg Hg/m3
Mesityl oxide	5,000 ppm	1,400 ppm [LEL]
Methoxychlor	N.E.	5,000 mg/m3
Methyl acetate	10,000 ppm	3,100 ppm [LEL]
Methyl acetylene	15,000 ppm[LEL]	1,700 ppm [LEL]
Methyl acetylenepropadiene Mixture	15,000 ppm	3,400 ppm [LEL]
Methyl acrylate	1,000 ppm	250 ppm
Methylal	15,000 ppm[LEL]	2,200 ppm [LEL]
Methyl alcohol	25,000 ppm	6,000 ppm
Methylamine	100 ppm	100 ppm [Unch]
Methyl (namyl) ketone	4,000 ppm	800 ppm
Methyl bromide	2,000 ppm	250 ppm

Methyl Cellosolve (r)	2,000 ppm	200 ppm
Methyl Cellosolve (r) acetate	4,000 ppm	200 ppm
Methyl chloride	10,000 ppm	2,000 ppm
Methyl chloroform	1,000 ppm	700 ppm
Methylcyclohexane	10,000 ppm	1,200 ppm [LEL]
Methylcyclohexanol	10,000 ppm	500 ppm
o-Methylcyclohexanone	2,500 ppm	600 ppm
Methylene bisphenyl isocyanate	100 mg/m3	75 mg/m3
Methylene chloride	5,000 ppm	2,300 ppm
Methyl formate	5,000 ppm	4,500 ppm
5-Methyl 3-heptanone	3,000 ppm	100 ppm
Methyl hydrazine	50 ppm	20 ppm
Methyl iodide	800 ppm	100 ppm
Methyl isobutyl carbinol	2,000 ppm	400 ppm
Methyl isocyanate	20 ppm	3 ppm
Methyl mercaptan	400 ppm	150 ppm
Methyl methacrylate	4,000 ppm	1,000 ppm
Methyl styrene	5,000 ppm	700 ppm
Mica	N.E.	1,500 mg/m3
Molybdenum (insoluble compounds, as Mo)	N.E.	5,000 mg Mo/m3
Molybdenum (soluble compounds, as Mo)	N.E.	1,000 mg Mo/m3
Monomethyl aniline	100 ppm	100 ppm [Unch]
Morpholine	8,000 ppm	1,400 ppm [LEL]
Naphtha (coal tar)	10,000 ppm[LEL]	1,000 ppm [LEL]
Naphthalene	500 ppm	250 ppm
Nickel carbonyl (as Ni)	7 ppm	2 ppm
Nickel metal and other compounds (as Ni)	N.E.	10 mg Ni/m3
Nicotine	35 mg/m3	5 mg/m3
Nitric acid	100 ppm	25 ppm
Nitric oxide	100 ppm	100 ppm [Unch]
p-Nitroaniline	300 mg/m3	300 mg/m3[Unch]
Nitrobenzene	200 ppm	200 ppm [Unch]
p-Nitrochlorobenzene	1,000 mg/m3	100 mg/m3
Nitroethane	1,000 ppm	1,000 ppm[Unch]
Nitrogen dioxide	50 ppm	20 ppm
Nitrogen trifluoride	2,000 ppm	1,000 ppm
Nitroglycerine	500 mg/m3	75 mg/m3
Nitromethane	1,000 ppm	750 ppm
1-Nitropropane	2,300 ppm	1,000 ppm
2-Nitropropane	2,300 ppm	100 ppm
Nitrotoluene (o, m,		

p isomers)	200 ppm	200 ppm [Unch]
Octachloronaphthalene	Unknown	Unknown [Unch]
Octane	5,000 ppm	1,000 ppm [LEL]
Oil mist (mineral)	N.E.	2,500 mg/m3
Osmium tetroxide (as Os)	1 mg Os/m3	1 mgOs/m3[Unch]
Oxalic acid	500 mg/m3	500 mg/m3[Unch]
Oxygen difluoride	0.5 ppm	0.5 ppm [Unch]
Ozone	10 ppm	5 ppm
Paraquat	1.5 mg/m3	1 mg/m3
Parathion	20 mg/m3	10 mg/m3
Pentaborane	3 ppm	1 ppm
Pentachloronaphthalen	Unknown	Unknown [Unch]
Pentachlorophenol	150 mg/m3	2.5 mg/m3
n-Pentane	15,000 ppm[LEL]	1,500 ppm
[LEL]		
2-Pentanone	5,000 ppm	1,500 ppm
Perchloromethyl mercaptan	10 ppm	10 ppm [Unch]
Perchloryl fluoride	385 ppm	100 ppm
Petroleum distillates (naphtha)	10,000 ppm	1,100 ppm [LEL]
Phenol	250 ppm	250 ppm [Unch]
p-Phenylene diamine	Unknown	25 mg/m3
Phenyl ether (vapor)	N.E.	100 ppm
Phenyl etherbiphenyl mixture (vapor)	N.E.	10 ppm
Phenyl glycidyl ether	Unknown	100 ppm
Phenylhydrazine	295 ppm	15 ppm
Phosdrin	4 ppm	4 ppm [Unch]
Phosgene	2 ppm	2 ppm [Unch]
Phosphine	200 ppm	50 ppm
Phosphoric acid	10,000 mg/m3	1,000 mg/m3
Phosphorus (yellow)	N.E.	5 mg/m3
Phosphorus pentachloride	200 mg/m3	70 mg/m3
Phosphorus pentasulfide	750 mg/m3	250 mg/m3
Phosphorus trichloride	50 ppm	25 ppm
Phthalic anhydride	10,000 mg/m3	60 mg/m3
Picric acid	100 mg/m3	75 mg/m3
Pindone	200 mg/m3	100 mg/m3
Platinum (soluble salts, as Pt)	N.E.	4 mg Pt/m3
Portland cement	N.E.	5,000 mg/m3
Propane	20,000 ppm[LEL]	2,100 ppm
[LEL]		
n-Propyl acetate	8,000 ppm	1,700 ppm
n-Propyl alcohol	4,000 ppm	800 ppm
Propylene dichloride	2,000 ppm	400 ppm

Propylene imine	500 ppm	100 ppm
Propylene oxide	2,000 ppm	400 ppm
n-Propyl nitrate	2,000 ppm	500 ppm
Pyrethrum	5,000 mg/m	35,000 mg/m3[Unch]
Pyridine	3,600 ppm	1,000 ppm
Quinone	300 mg/m3	100 mg/m3
Rhodium (metal fume and insoluble N.E. compounds, as Rh)		100 mg Rh/m3
Rhodium (soluble compounds, as Rh)N.E.		2 mg Rh/m3
Ronnel	5,000 mg/m3	300 mg/m3
Rotenone	Unknown	2,500 mg/m3
Selenium compounds (as Se)	Unknown	1 mg Se/m3
Selenium hexafluoride	5 ppm	2 ppm
Silica, amorphous	N.E.	3,000 mg/m3
Silica, crystalline (respirable dust) N.E. cristobalite/tridymite:		25 mg/m3
quartz/tripoli:		50 mg/m3
Silver (metal dust and soluble N.E. compounds, as Ag)		10 mg Ag/m3
Soapstone	N.E.	3,000 mg/m3
Sodium fluoroacetate	5 mg/m3	2.5 mg/m3
Sodium hydroxide	250 mg/m3	10 mg/m3
Stibine	40 ppm	5 ppm
Stoddard solvent	29,500 mg/m3	20,000 mg/m3
Strychnine	3 mg/m3	3 mg/m3
[Unch]		
Styrene	5,000 ppm	700 ppm
Sulfur dioxide	100 ppm	100 ppm
[Unch]		
Sulfuric acid	80 mg/m3	15 mg/m3
Sulfur monochloride	10 ppm	5 ppm
Sulfur pentafluoride	1 ppm	1 ppm
[Unch]		
Sulfuryl fluoride	1,000 ppm	200 ppm
2,4,5-T	Unknown	250 mg/m3
Talc	N.E.	1,000 mg/m3
Tantalum (metal and oxide dust, as Ta) N.E.		2,500 mg Ta/m3
TEDP	35 mg/m3	10 mg/m3
Tellurium compounds (as Te) N.E.		25 mg Te/m3

Tellurium hexafluoride	1 ppm	1 ppm [Unch]
TEPP	10 mg/m ³	5 mg/m ³
Terphenyl (o, m, p isomers)	Unknown	500 mg/m ³
1,1,1,2-Tetrachloro 2, 2-difluoroethane	15,000 ppm	2,000 ppm
1,1,2,2-Tetrachloro 1, 2-difluoroethane	15,000 ppm	2,000 ppm
1,1,2,2-Tetrachloroethane	150 ppm	100 ppm
Tetrachloroethylene	500 ppm	150 ppm
Tetrachloronaphthalene	Unknown	Unknown [Unch]
Tetraethyl lead (as Pb) Pb/m ³ [Unch]	40 mg Pb/m ³	40 mg
Tetrahydrofuran [LEL]	20,000 ppm [LEL]	2,000 ppm
Tetramethyl lead (as Pb) [Unch]	40 mg Pb/m ³	40 mg Pb/m ³
Tetramethyl succinonitrile	5 ppm	5 ppm [Unch]
Tetranitromethane	5 ppm	4 ppm
Tetryl	N.E.	750 mg/m ³
Thallium (soluble compounds, as Tl)	20 mg Tl/m ³	15 mg Tl/m ³
Thiram	1,500 mg/m ³	100 mg/m ³
Tin (inorganic compounds, as Sn)	400 mg Sn/m ³	100 mg Sn/m ³
Tin (organic compounds, as Sn)	Unknown	25 mg Sn/m ³
Titanium dioxide	N.E.	5,000 mg/m ³
Toluene	2,000 ppm	500 ppm
Toluene 2,4-diisocyanate	10 ppm	2.5 ppm
o-Toluidine	100 ppm	50 ppm
Tributyl phosphate	125 ppm	30 ppm
1,1,2-Trichloroethane	500 ppm	100 ppm
Trichloroethylene	1,000 ppm	1,000 ppm [Unch]
Trichloronaphthalene	Unknown	Unknown [Unch]
1,2,3-Trichloropropane	1,000 ppm	100 ppm
1,1,2-Trichloro 1,2, 2-trifluoroethane	4,500 ppm	2,000 ppm
Triethylamine	1,000 ppm	200 ppm
Trifluorobromomethane	50,000 ppm	40,000 ppm
2,4,6-Trinitrotoluene	1,000 mg/m ³	500 mg/m ³
Triorthocresyl phosphate	40 mg/m ³	40 mg/m ³ [Unch]
Triphenyl phosphate	N.E.	1,000 mg/m ³
Turpentine	1,500 ppm	800 mg
Uranium (insoluble compounds, as U)	30 mg U/m ³	10 mg U/m ³
Uranium (soluble compounds, as U)	20 mg U/m ³	10 mg U/m ³

Vanadium dust	70 mg/m ³ (as V ₂ O ₅)	35 mg V/m ³
Vanadium fume	70 mg/m ³ (as V ₂ O ₅)	35 mg V/m ³
Vinyl toluene	5,000 ppm	400 ppm
Warfarin	350 mg/m ³	100 mg/m ³
Xylene (o, m, p isomers)	1,000 ppm	900 ppm
Xylidine	150 ppm	50 ppm
Yttrium compounds (as Y)	N.E.	500 mg Y/m ³
Zinc chloride fume	4,800 mg/m ³	50 mg/m ³
Zinc oxide	2,500 mg/m ³	500 mg/m ³
Zirconium compounds (as Zr)	500 mg Zr/m ³	50 mg Zr/m ³

APPENDIX III

Appendix III

Hazardous Material Spill Procedures for Major Spills

The following procedure applies to:

- Laboratory personnel
- Education personnel
- Maintenance personnel
- Outside Contractor Personnel
- Environmental Services personnel
- Administrative personnel

In the event of a major spill in a university area, all laboratory, education, maintenance, outside contractor, administrative, and/or environmental services personnel will implement the following plan:

6. Notify persons in the immediate area that a spill has occurred.
7. Avoid breathing vapors, mists or dust of the spilled material.
8. Turn off all ignition sources.
9. Evacuate room and close the door
10. Contact the Emergency Operator

DREXEL UNIVERSITY - Phone # 80 (using any in-house phone)
Drexel – 215-895-2222

In order to assess the situation be prepared to provide the following information:

- Name and call back number
 - The location of the spill (building and room number)
 - Type of material spilled
 - The amount of material that spilled
11. Remain on or near the telephone until you have received instructions from the emergency operator or security or University Safety & Health.

APPENDIX IV

APPENDIX IV

Hazardous Material Spill Procedures For Minor Spills

In the event of a minor spill the following emergency procedures shall be implemented.

Occupied Laboratories:

- Laboratory personnel will be responsible for the containment and clean up of all **minor** spills.
- Proper personal protection equipment shall be donned during the clean up of all **minor** spills. If the laboratory personnel does not have the proper personal protective equipment then contact the University Department of Safety & Health for assistance. All non-disposable personal protective equipment shall be decontaminated and stored.
- All disposable personal protective equipment and clean up materials shall be disposed of as hazardous waste.
- If the material spilled is not covered under the **minor** spill definition (< 500 ml of non-acutely hazardous material) then laboratory personnel shall implement the **major spill procedures**.

Education and Vacant Laboratories:

All **minor** spills occurring in vacant laboratories, education/prep laboratories, or any other university area shall be considered a major spill. Therefore, anyone observing a minor spill in these areas shall implement the major spill procedures.

APPENDIX V

Appendix V

Related and Compatible Storage Groups

Inorganic Family	Nitric acid, other inorganic acids
Metals, hydrides	Sulfur, phosphorus, arsenic, phosphorus pentoxide
Halides, sulfates, sulfites, thiosulfates, phosphates, halogens	Organic Family
Amides, nitrates (except ammonium nitrate), nitrites, azides	Acids, anhydrides, peracids
Hydroxides, oxides, silicates, carbonates, carbon	Alcohols, glycols, amines, amides, imines, imides
Sulfides, selenides, phosphides, carbides, nitrides	Hydrocarbons, esters, aldehydes
Chlorates, perchlorates, perchloric acid, chlorites, hypochlorites, peroxides, hydrogen peroxide	Ethers, ketones, ketenes, halogenated hydrocarbons, ethylene oxide
Arsenates, cyanides, cyanates	Peroxides, hydroperoxides, azides
Borates, chromates, manganates, Permanganates	Sulfides, polysulfides, sulfoxides, Nitrites
	Phenols, cresols

NOTE: Store flammables in a storage cabinet for flammable liquids or in safety cans. Separate chemicals into their organic and inorganic families and then related and compatible groups, as shown. Separation of chemical groups can be by different shelves within the same cabinet.

Do NOT store chemicals alphabetically as a general group. This may result in incompatibles appearing together on a shelf. Rather, store alphabetically within compatible groups.

This listing is only a suggested method of arranging chemical materials for storage and is not intended to be complete.

APPENDIX VI

APPENDIX VI - Regulations (Standards - 29 CFR)

TABLE Z-1 Limits for Air Contaminants. - 1910.1000TABLEZ-1

- **Standard Number:** 1910.1000TABLEZ-1
 - **Standard Title:** TABLE Z-1 Limits for Air Contaminants.
 - **SubPart Number:** Z
 - **SubPart Title:** Toxic and Hazardous Substances
-

TABLE Z-1 LIMITS FOR AIR CONTAMINANTS

NOTE: Because of the length of the table, explanatory Footnotes applicable to all substances are given below as well as at the end of the table. Footnotes specific only to a limited number of substances are also shown within the table.

Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste

processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(2) See Table Z-2.

Footnote(3) See Table Z-3

Footnote(4) Varies with compound.

TABLE Z-1. - LIMITS FOR AIR CONTAMINANTS

Substance	CAS No. (c)	ppm (a)(1)	mg/m(3) (b)(1)	Skin designation
Acetaldehyde.....	75-07-0	200	360	
Acetic acid.....	64-19-7	10	25	
Acetic anhydride.....	108-24-7	5	20	
Acetone.....	67-64-1	1000	2400	
Acetonitrile.....	75-05-8	40	70	
2-Acetylaminofluorene; see 1910.1014.....	53-96-3			
Acetylene dichloride; see 1,2-Dichloroethylene.				
Acetylene tetrabromide.	79-27-6	1	14	
Acrolein.....	107-02-8	0.1	0.25	
Acrylamide.....	79-06-1	.....	0.3	X
Acrylonitrile; see 1910.1045.....	107-13-1			
Aldrin.....	309-00-2	.....	0.25	X
Allyl alcohol.....	107-18-6	2	5	X
Allyl chloride.....	107-05-1	1	3	
Allyl glycidyl ether... (AGE).....	106-92-3	(C)10	(C)45	
Allyl propyl disulfide.	2179-59-1	2	12	
alpha-Alumina.....	1344-28-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Aluminum Metal (as Al).	7429-90-5			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
4-Aminodiphenyl; see 1910.1011.....	92-67-1			
2-Aminoethanol; see Ethanolamine.....				
2-Aminopyridine.....	504-29-0	0.5	2	

Ammonia.....	7664-41-7	50	35	
Ammonium sulfamate.....	7773-06-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
n-Amyl acetate.....	628-63-7	100	525	
sec-Amyl acetate.....	626-38-0	125	650	
Aniline and homologs...	62-53-3	5	19	X
Anisidine				
(o-,p-isomers).....	29191-52-4	.....	0.5	X
Antimony and compounds				
(as Sb).....	7440-36-0	.....	0.5	
ANTU (alpha				
Naphthylthiourea)....	86-88-4	.....	0.3	
Arsenic, inorganic				
compounds (as As);				
see 1910.1018.....	7440-38-2			
Arsenic, organic				
compounds (as As)....	7440-38-2	.....	0.5	
Arsine.....	7784-42-1	0.05	0.2	
Asbestos;				
see 1910.1001.....	(4)			
Azinphos-methyl.....	86-50-0	.....	0.2	X
Barium, soluble				
compounds (as Ba)....	7440-39-3	.....	0.5	
Barium sulfate.....	7727-43-7			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Benomyl.....	17804-35-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Benzene; See 1910.1028.	71-43-2			
See Table Z-2 for				
the limits				
applicable in the				
operations or				
sectors excluded				
in 1910.1028(d)				
Benzidine;				
See 1910.1010.....	92-87-5			
p-Benzoquinone;				
see Quinone.				
Benzo(a)pyrene; see				
Coal tar pitch				
volatiles.....				
Benzoyl peroxide.....	94-36-0	.....	5	
Benzyl chloride.....	100-44-7	1	5	
Beryllium and				
beryllium compounds				
(as Be).....	7440-41-7		(2)	
Biphenyl; see Diphenyl.				
Bismuth telluride,				
Undoped.....	1304-82-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Boron oxide.....	1303-86-2			
Total dust.....		.....	15	

Boron trifluoride.....	7637-07-2	(C)1	(C)3	
Bromine.....	7726-95-6	0.1	0.7	
Bromoform.....	75-25-2	0.5	5	X
Butadiene (1,3-Butadiene); See 29 CFR 1910.1051; 29 CFR 1910.19(1).....	106-99-0	1 ppm/5 ppm STEL		
Butanethiol; see Butyl mercaptan.				
2-Butanone (Methyl ethyl ketone)	78-93-3	200	590	
2-Butoxyethanol.....	111-76-2	50	240	X
n-Butyl-acetate.....	123-86-4	150	710	
sec-Butyl acetate.....	105-46-4	200	950	
tert-Butyl-acetate.....	540-88-5	200	950	
n-Butyl alcohol.....	71-36-3	100	300	
sec-Butyl alcohol.....	78-92-2	150	450	
tert-Butyl alcohol.....	75-65-0	100	300	
Butylamine.....	109-73-9	(C)5	(C)15	X
tert-Butyl chromate (as CrO(3)).....	1189-85-1	.....	(C)0.1	X
n-Butyl glycidyl ether (BGE).....	2426-08-6	50	270	
Butyl mercaptan.....	109-79-5	10	35	
p-tert-Butyltoluene....	98-51-1	10	60	
Cadmium (as Cd); see 1910.1027.....	7440-43-9			
Calcium Carbonate.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Calcium hydroxide.....	1305-62-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Calcium oxide.....	1305-78-8	.....	5	
Calcium silicate.....	1344-95-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Calcium sulfate.....	7778-18-9			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Camphor, synthetic.....	76-22-2	.....	2	
Carbaryl (Sevin).....	63-25-2	.....	5	
Carbon black.....	1333-86-4	.....	3.5	
Carbon dioxide.....	124-38-9	5000	9000	
Carbon disulfide.....	75-15-0		(2)	
Carbon monoxide.....	630-08-0	50	55	
Carbon tetrachloride...	56-23-5		(2)	
Cellulose.....	9004-34-6			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Chlordane.....	57-74-9	.....	0.5	X
Chlorinated camphene...	8001-35-2	.....	0.5	X
Chlorinated diphenyl oxide.....	55720-99-5	.....	0.5	
Chlorine.....	7782-50-5	(C)1	(C)3	
Chlorine dioxide.....	10049-04-4	0.1	0.3	

Chlorine trifluoride...	7790-91-2	(C)0.1	(C)0.4	
Chloroacetaldehyde.....	107-20-0	(C)1	(C)3	
a-Chloroacetophenone (Phenacyl chloride)...	532-27-4	0.05	0.3	
Chlorobenzene.....	108-90-7	75	350	
o-Chlorobenzylidene malononitrile.....	2698-41-1	0.05	0.4	
Chlorobromomethane.....	74-97-5	200	1050	
2-Chloro-1,3-butadiene; See beta-Chloroprene.				
Chlorodiphenyl (42% Chlorine)(PCB)...	53469-21-9	.....	1	X
Chlorodiphenyl (54% Chlorine)(PCB)...	11097-69-1	.....	0.5	X
1-Chloro-2, 3-epoxypropane; See Epichlorohydrin.				
2-Chloroethanol; See Ethylene chlorohydrin				
Chloroethylene; See Vinyl chloride.				
Chloroform (Trichloromethane)...	67-66-3	(C)50	(C)240	
bis(Chloromethyl) ether; see 1910.1008.	542-88-1			
Chloromethyl methyl ether; see 1910.1006.	107-30-2			
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin.....	76-06-2	0.1	0.7	
beta-Chloroprene.....	126-99-8	25	90	X
2-Chloro-6 (trichloromethyl) pyridine.....	1929-82-4			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Chromic acid and chromates (as CrO(3))	(4)		(2)	
Chromium (II) compounds (as Cr).....	7440-47-3	.....	0.5	
Chromium (III) compounds (as Cr)....	7440-47-3	.....	0.5	
Chromium metal and insol. salts (as Cr)..	7440-47-3	.....	1	
Chrysene; see Coal tar pitch volatiles.....				
Clopidol.....	2971-90-6			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Coal dust (less than 5% SiO(2)), respirable fraction..			(3)	
Coal dust (greater than or equal to 5% SiO(2)), respirable fraction.....			(3)	
Coal tar pitch				

volatiles (benzene soluble fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene.....	65966-93-2	.....	0.2	
Cobalt metal, dust, and fume (as Co).....	7440-48-4	.....	0.1	
Coke oven emissions; see 1910.1029.....				
Copper.....	7440-50-8			
Fume (as Cu).....		.....	0.1	
Dusts and mists (as Cu).....		.....	1	
Cotton dust (e), see 1910.1043.....		.....	1	
Crag herbicide (Sesone)	136-78-7			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Cresol, all isomers....	1319-77-3	5	22	X
Crotonaldehyde.....	123-73-9	2	6	
	4170-30-3			
Cumene.....	98-82-8	50	245	X
Cyanides (as CN).....	(4)	.....	5	X
Cyclohexane.....	110-82-7	300	1050	
Cyclohexanol.....	108-93-0	50	200	
Cyclohexanone.....	108-94-1	50	200	
Cyclohexene.....	110-83-8	300	1015	
Cyclopentadiene.....	542-92-7	75	200	
2,4-D (Dichlorophen-oxyacetic acid).....	94-75-7	.....	10	
Decaborane.....	17702-41-9	0.05	0.3	X
Demeton (Systox).....	8065-48-3	.....	0.1	X
Diacetone alcohol (4-Hydroxy-4-methyl-2-pentanone).....	123-42-2	50	240	
1,2-Diaminoethane; see Ethylenediamine..				
Diazomethane.....	334-88-3	0.2	0.4	
Diborane.....	19287-45-7	0.1	0.1	
1,2-Dibromo-3-chloropropane (DBCP); see 1910.1044.....	96-12-8			
1,2-Dibromoethane; see Ethylene dibromide...				
Dibutyl phosphate.....	107-66-4	1	5	
Dibutyl phthalate.....	84-74-2	.....	5	
o-Dichlorobenzene.....	95-50-1	(C)50	(C)300	
p-Dichlorobenzene.....	106-46-7	75	450	
3,3'-Dichlorobenzidine; see 1910.1007.....	91-94-1			
Dichlorodifluoromethane	75-71-8	1000	4950	
1,3-Dichloro-5,5-dimethyl hydantoin.	118-52-5	.....	0.2	
Dichlorodiphenyltri-chloroethane (DDT)...	50-29-3	.....	1	X

1,1-Dichloroethane.....	75-34-3	100	400	
1,2-Dichloroethane; see Ethylene dichloride..				
1,2-Dichloroethylene...	540-59-0	200	790	
Dichloroethyl ether....	111-44-4	(C)15	(C)90	X
Dichloromethane; see Methylene chloride...				
Dichloromonofluoro- methane.....	75-43-4	1000	4200	
1,1-Dichloro-1- nitroethane.....	594-72-9	(C)10	(C)60	
1,2-Dichloropropane; see Propylene dichloride.				
Dichlorotetrafluoro- ethane.....	76-14-2	1000	7000	
Dichlorvos (DDVP).....	62-73-7	.....	1	X
Dicyclopentadienyl iron Total dust.....	102-54-5	.....	15	
Respirable fraction..		.....	5	
Dieldrin.....	60-57-1	.....	0.25	X
Diethylamine.....	109-89-7	25	75	
2-Diethylaminoethanol..	100-37-8	10	50	X
Diethyl ether; see Ethyl ether.....				
Difluorodibromomethane.	75-61-6	100	860	
Diglycidyl ether (DGE).	2238-07-5	(C)0.5	(C)2.8	
Dihydroxybenzene; see Hydroquinone.....				
Diisobutyl ketone.....	108-83-8	50	290	
Diisopropylamine.....	108-18-9	5	20	X
4-Dimethylaminoazo- benzene; see 1910.1015.....	60-11-7			
Dimethoxymethane; see Methylal.....				
Dimethyl acetamide.....	127-19-5	10	35	X
Dimethylamine.....	124-40-3	10	18	
Dimethylaminobenzene; see Xylidine.....				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene; see Xylene.....				
Dimethyl-1,2-dibromo-2, 2-dichloroethyl phosphate.....	300-76-5	.....	3	
Dimethylformamide.....	68-12-2	10	30	X
2,6-Dimethyl-4- heptanone; see Diisobutyl ketone....				
1,1-Dimethylhydrazine..	57-14-7	0.5	1	X
Dimethylphthalate.....	131-11-3	.....	5	
Dimethyl sulfate.....	77-78-1	1	5	X
Dinitrobenzene (all isomers).....			1	X

(ortho).....	528-29-0				
(meta).....	99-65-0				
(para).....	100-25-4				
Dinitro-o-cresol.....	534-52-1	.....	0.2		X
Dinitrotoluene.....	25321-14-6	.....	1.5		X
Dioxane					
(Diethylene dioxide)..	123-91-1	100	360		X
Diphenyl (Biphenyl)....	92-52-4	0.2	1		
Diphenylmethane					
diisocyanate; see					
Methylene bisphenyl					
isocyanate.....					
Dipropylene glycol					
methyl ether.....	34590-94-8	100	600		X
Di-sec octyl phthalate					
(Di-(2-ethylhexyl)					
phthalate).....	117-81-7	.....	5		
Emery.....	12415-34-8				
Total dust.....		.....	15		
Respirable fraction..		.....	5		
Endrin.....	72-20-8	.....	0.1		X
Epichlorohydrin.....	106-89-8	5	19		X
EPN.....	2104-64-5	.....	0.5		X
1,2-Epoxypropane; see					
Propylene oxide.....					
2,3-Epoxy-1-propanol;					
see Glycidol.....					
Ethanethiol; see					
Ethyl mercaptan.....					
Ethanolamine.....	141-43-5	3	6		
2-Ethoxyethanol					
(Cellosolve).....	110-80-5	200	740		X
2-Ethoxyethyl acetate					
(Cellosolve acetate)..	111-15-9	100	540		X
Ethyl acetate.....	141-78-6	400	1400		
Ethyl acrylate.....	140-88-5	25	100		X
Ethyl alcohol (Ethanol)	64-17-5	1000	1900		
Ethylamine.....	75-04-7	10	18		
Ethyl amyl ketone					
(5-Methyl-3-					
heptanone).....	541-85-5	25	130		
Ethyl benzene.....	100-41-4	100	435		
Ethyl bromide.....	74-96-4	200	890		
Ethyl butyl ketone					
(3-Heptanone).....	106-35-4	50	230		
Ethyl chloride.....	75-00-3	1000	2600		
Ethyl ether.....	60-29-7	400	1200		
Ethyl formate.....	109-94-4	100	300		
Ethyl mercaptan.....	75-08-1	(C)10	(C)25		
Ethyl silicate.....	78-10-4	100	850		
Ethylene chlorohydrin..	107-07-3	5	16		X
Ethylenediamine.....	107-15-3	10	25		
Ethylene dibromide.....	106-93-4		(2)		
Ethylene dichloride					
(1,2-Dichloroethane)..	107-06-2		(2)		
Ethylene glycol					

dinitrate.....	628-96-6	(C)0.2	(C)1	X
Ethylene glycol methyl acetate; see Methyl cellosolve acetate...				
Ethyleneimine; see 1910.1012.....	151-56-4			
Ethylene oxide; see 1910.1047.....	75-21-8			
Ethylidene chloride; see 1,1-Dichlorethane				
N-Ethylmorpholine.....	100-74-3	20	94	X
Ferbam.....	14484-64-1			
Total dust.....			15	
Ferrovandium dust.....	12604-58-9		1	
Fluorides (as F).....	(4)		2.5	
Fluorine.....	7782-41-4	0.1	0.2	
Fluorotrchloromethane (Trichloro-fluoromethane).....	75-69-4	1000	5600	
Formaldehyde; see 1910.1048.....	50-00-0			
Formic acid.....	64-18-6	5	9	
Furfural.....	98-01-1	5	20	X
Furfuryl alcohol.....	98-00-0	50	200	
Grain dust (oat, wheat barley).....			10	
Glycerin (mist).....	56-81-5			
Total dust.....			15	
Respirable fraction..			5	
Glycidol.....	556-52-5	50	150	
Glycol monoethyl ether; see 2-Ethoxyethanol..				
Graphite, natural respirable dust.....	7782-42-5		(3)	
Graphite, synthetic... Total dust.....			15	
Respirable Fraction..			5	
Guthion; see Azinphos methyl..				
Gypsum.....	13397-24-5			
Total dust.....			15	
Respirable fraction..			5	
Hafnium.....	7440-58-6		0.5	
Heptachlor.....	76-44-8		0.5	X
Heptane (n-Heptane)....	142-82-5	500	2000	
Hexachloroethane.....	67-72-1	1	10	X
Hexachloronaphthalene..	1335-87-1		0.2	X
n-Hexane.....	110-54-3	500	1800	
2-Hexanone (Methyl n-butyl ketone).....	591-78-6	100	410	
Hexone (Methyl isobutyl ketone).....	108-10-1	100	410	
sec-Hexyl acetate.....	108-84-9	50	300	
Hydrazine.....	302-01-2	1	1.3	X
Hydrogen bromide.....	10035-10-6	3	10	
Hydrogen chloride.....	7647-01-0	(C)5	(C)7	

Hydrogen cyanide.....	74-90-8	10	11	X
Hydrogen fluoride (as F).....	7664-39-3		(2)	
Hydrogen peroxide.....	7722-84-1	1	1.4	
Hydrogen selenide (as Se).....	7783-07-5	0.05	0.2	
Hydrogen sulfide.....	7783-06-4		(2)	
Hydroquinone.....	123-31-9	.....	2	
Iodine.....	7553-56-2	(C)0.1	(C)1	
Iron oxide fume.....	1309-37-1	.....	10	
Isomyl acetate.....	123-92-2	100	525	
Isomyl alcohol (primary and secondary).....	123-51-3	100	360	
Isobutyl acetate.....	110-19-0	150	700	
Isobutyl alcohol.....	78-83-1	100	300	
Isophorone.....	78-59-1	25	140	
Isopropyl acetate.....	108-21-4	250	950	
Isopropyl alcohol.....	67-63-0	400	980	
Isopropylamine.....	75-31-0	5	12	
Isopropyl ether.....	108-20-3	500	2100	
Isopropyl glycidyl ether (IGE).....	4016-14-2	50	240	
Kaolin.....	1332-58-7			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Ketene.....	463-51-4	0.5	0.9	
Lead inorganic (as Pb); see 1910.1025.....	7439-92-1			
Limestone.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Lindane.....	58-89-9	.....	0.5	X
Lithium hydride.....	7580-67-8	.....	0.025	
L.P.G. (Liquified petroleum gas).....	68476-85-7	1000	1800	
Magnesite.....	546-93-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Magnesium oxide fume...	1309-48-4			
Total Particulate....		.....	15	
Malathion.....	121-75-5			
Total dust.....		.....	15	X
Maleic anhydride.....	108-31-6	0.25	1	
Manganese compounds (as Mn).....	7439-96-5	.....	(C)5	
Manganese fume (as Mn)..	7439-96-5	.....	(C)5	
Marble.....	1317-65-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Mercury (aryl and inorganic)(as Hg)....	7439-97-6		(2)	
Mercury (organo) alkyl compounds (as Hg)....	7439-97-6		(2)	
Mercury (vapor) (as Hg)	7439-97-6		(2)	
Mesityl oxide.....	141-79-7	25	100	

Methanethiol; see Methyl mercaptan.				
Methoxychlor.....	72-43-5			
Total dust.....		.....	15	
2-Methoxyethanol; (Methyl cellosolve)...	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate).....	110-49-6	25	120	X
Methyl acetate.....	79-20-9	200	610	
Methyl acetylene (Propyne).....	74-99-7	1000	1650	
Methyl acetylene propadiene mixture (MAPP).....		1000	1800	
Methyl acrylate.....	96-33-3	10	35	X
Methylal (Dimethoxy-methane)...	109-87-5	1000	3100	
Methyl alcohol.....	67-56-1	200	260	
Methylamine.....	74-89-5	10	12	
Methyl amyl alcohol; see Methyl Isobutyl carbinol.....				
Methyl n-amyl ketone...	110-43-0	100	465	
Methyl bromide.....	74-83-9	(C)20	(C)80	X
Methyl butyl ketone; see 2-Hexanone.....				
Methyl cellosolve; see 2-Methoxyethanol.				
Methyl cellosolve acetate; see 2-Methoxyethyl acetate.....				
Methyl chloride.....	74-87-3		(2)	
Methyl chloroform (1,1,1-Trichloro- ethane).....	71-55-6	350	1900	
Methylcyclohexane.....	108-87-2	500	2000	
Methylcyclohexanol.....	25639-42-3	100	470	
o-Methylcyclohexanone..	583-60-8	100	460	X
Methylene chloride.....	75-09-2		(2)	
Methyl ethyl ketone (MEK); see 2-Butanone				
Methyl formate.....	107-31-3	100	250	
Methyl hydrazine (Monomethyl hydrazine).....	60-34-4	(C)0.2	(C)0.35	X
Methyl iodide.....	74-88-4	5	28	X
Methyl isoamyl ketone..	110-12-3	100	475	
Methyl isobutyl carbinol.....	108-11-2	25	100	X
Methyl isobutyl ketone; see Hexone.....				
Methyl isocyanate.....	624-83-9	0.02	0.05	X
Methyl mercaptan.....	74-93-1	(C)10	(C)20	
Methyl methacrylate....	80-62-6	100	410	

Methyl propyl ketone; see 2-Pentanone.....					
alpha-Methyl styrene...	98-83-9	(C)100	(C)480		
Methylene bisphenyl isocyanate (MDI).....	101-68-8	(C)0.02	(C)0.2		
Mica; see Silicates....					
Molybdenum (as Mo).....	7439-98-7				
Soluble compounds....		.....	5		
Insoluble Compounds					
Total dust.....		.....	15		
Monomethyl aniline.....	100-61-8	2	9		X
Monomethyl hydrazine; see Methyl hydrazine.					
Morpholine.....	110-91-8	20	70		X
Naphtha (Coal tar).....	8030-30-6	100	400		
Naphthalene.....	91-20-3	10	50		
alpha-Naphthylamine; see 1910.1004.....	134-32-7				
beta-Naphthylamine; see 1910.1009.....	91-59-8				
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007		
Nickel, metal and insoluble compounds (as Ni).....	7440-02-0	.....	1		
Nickel, soluble compounds (as Ni)....	7440-02-0	.....	1		
Nicotine.....	54-11-5	.....	0.5		X
Nitric acid.....	7697-37-2	2	5		
Nitric oxide.....	10102-43-9	25	30		
p-Nitroaniline.....	100-01-6	1	6		X
Nitrobenzene.....	98-95-3	1	5		X
p-Nitrochlorobenzene...	100-00-5	.....	1		X
4-Nitrodiphenyl; see 1910.1003.....	92-93-3				
Nitroethane.....	79-24-3	100	310		
Nitrogen dioxide.....	10102-44-0	(C)5	(C)9		
Nitrogen trifluoride...	7783-54-2	10	29		
Nitroglycerin.....	55-63-0	(C)0.2	(C)2		X
Nitromethane.....	75-52-5	100	250		
1-Nitropropane.....	108-03-2	25	90		
2-Nitropropane.....	79-46-9	25	90		
N-Nitrosodimethylamine; see 1910.1016					
Nitrotoluene (all isomers).....		5	30		X
o-isomer.....	88-72-2				
m-isomer.....	99-08-1				
p-isomer.....	99-99-0				
Nitrotrichloromethane; see Chloropicrin.....					
Octachloronaphthalene..	2234-13-1	.....	0.1		X
Octane.....	111-65-9	500	2350		
Oil mist, mineral.....	8012-95-1	.....	5		
Osmium tetroxide (as Os).....	20816-12-0	.....	0.002		
Oxalic acid.....	144-62-7	.....	1		

Oxygen difluoride.....	7783-41-7	0.05	0.1	
Ozone.....	10028-15-6	0.1	0.2	
Paraquat, respirable dust.....	4685-14-7 1910-42-5 2074-50-2	.....	0.5	X
Parathion.....	56-38-2	.....	0.1	X
Particulates not otherwise regulated (PNOR)(f).....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
PCB; see Chlorodiphenyl (42% and 54% chlorine).....				
Pentaborane.....	19624-22-7	0.005	0.01	
Pentachloronaphthalene.	1321-64-8	.....	0.5	X
Pentachlorophenol.....	87-86-5	.....	0.5	X
Pentaerythritol.....	115-77-5			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Pentane.....	109-66-0	1000	2950	
2-Pentanone (Methyl propyl ketone).....	107-87-9	200	700	
Perchloroethylene (Tetrachloroethylene)	127-18-4		(2)	
Perchloromethyl mercaptan.....	594-42-3	0.1	0.8	
Perchloryl fluoride....	7616-94-6	3	13.5	
Petroleum distillates (Naphtha)(Rubber Solvent).....		500	2000	
Phenol.....	108-95-2	5	19	X
p-Phenylene diamine....	106-50-3	.....	0.1	X
Phenyl ether, vapor....	101-84-8	1	7	
Phenyl ether-biphenyl mixture, vapor.....		1	7	
Phenylethylene; see Styrene.....				
Phenyl glycidyl ether (PGE).....	122-60-1	10	60	
Phenylhydrazine.....	100-63-0	5	22	X
Phosdrin (Mevinphos)...	7786-34-7	.....	0.1	X
Phosgene (Carbonyl chloride).....	75-44-5	0.1	0.4	
Phosphine.....	7803-51-2	0.3	0.4	
Phosphoric acid.....	7664-38-2	.....	1	
Phosphorus (yellow)....	7723-14-0	.....	0.1	
Phosphorus pentachloride.....	10026-13-8	.....	1	
Phosphorus pentasulfide	1314-80-3	.....	1	
Phosphorus trichloride.	7719-12-2	0.5	3	
Phthalic anhydride.....	85-44-9	2	12	
Picloram.....	1918-02-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	

Picric acid.....	88-89-1	.....	0.1	X
Pindone (2-Pivalyl-1, 3-indandione).....	83-26-1	.....	0.1	
Plaster of paris.....	26499-65-0			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Platinum (as Pt).....	7440-06-4			
Metal.....		.....	.....
Soluble Salts.....		.....	0.002	
Portland cement.....	65997-15-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Propane.....	74-98-6	1000	1800	
beta-Propriolactone; see 1910.1013.....	57-57-8			
n-Propyl acetate.....	109-60-4	200	840	
n-Propyl alcohol.....	71-23-8	200	500	
n-Propyl nitrate.....	627-13-4	25	110	
Propylene dichloride...	78-87-5	75	350	
Propylene imine.....	75-55-8	2	5	X
Propylene oxide.....	75-56-9	100	240	
Propyne; see Methyl acetylene.....				
Pyrethrum.....	8003-34-7	.....	5	
Pyridine.....	110-86-1	5	15	
Quinone.....	106-51-4	0.1	0.4	
RDX: see Cyclonite.....				
Rhodium (as Rh), metal fume and insoluble compounds.....	7440-16-6	.....	0.1	
Rhodium (as Rh), soluble compounds....	7440-16-6	.....	0.001	
Ronnell.....	299-84-3	.....	15	
Rotenone.....	83-79-4	.....	5	
Rouge.....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Selenium compounds (as Se).....	7782-49-2	.....	0.2	
Selenium hexafluoride (as Se).....	7783-79-1	0.05	0.4	
Silica, amorphous, precipitated and gel.	112926-00-8		(3)	
Silica, amorphous, diatomaceous earth, containing less than 1% crystalline silica	61790-53-2		(3)	
Silica, crystalline cristobalite, respirable dust.....	14464-46-1		(3)	
Silica, crystalline quartz, respirable dust.....	14808-60-7		(3)	
Silica, crystalline tripoli (as quartz), respirable dust.....	1317-95-9		(3)	

Silica, crystalline tridymite, respirable dust.....	15468-32-3		(3)	
Silica, fused, respirable dust.....	60676-86-0		(3)	
Silicates (less than 1% crystalline silica)				
Mica (respirable dust).....	12001-26-2		(3)	
Soapstone, total dust			(3)	
Soapstone, respirable dust.....			(3)	
Talc (containing asbestos): use asbestos limit: see 29 CFR 1910.1001.....			(3)	
Talc (containing no asbestos), respirable dust.....	14807-96-6		(3)	
Tremolite, asbestiform; see 1910.1001.....				
Silicon.....	7440-21-3			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Silicon carbide.....	409-21-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Silver, metal and soluble compounds (as Ag).....	7440-22-4	.....	0.01	
Soapstone; see Silicates.....				
Sodium fluoroacetate...	62-74-8	.....	0.05	X
Sodium hydroxide.....	1310-73-2	.....	2	
Starch.....	9005-25-8			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Stibine.....	7803-52-3	0.1	0.5	
Stoddard solvent.....	8052-41-3	500	2900	
Strychnine.....	57-24-9	.....	0.15	
Styrene.....	100-42-5		(2)	
Sucrose.....	57-50-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Sulfur dioxide.....	7446-09-5	5	13	
Sulfur hexafluoride....	2551-62-4	1000	6000	
Sulfuric acid.....	7664-93-9	.....	1	
Sulfur monochloride....	10025-67-9	1	6	
Sulfur pentafluoride...	5714-22-7	0.025	0.25	
Sulfuryl fluoride.....	2699-79-8	5	20	
Systox; see Demeton...				
2,4,5-T (2,4,5-tri- chlorophenoxyacetic acid).....	93-76-5	.....	10	
Talc; see Silicates...				

Tantalum, metal and oxide dust.....	7440-25-7	.....	5	
TEDP (Sulfotep).....	3689-24-5	.....	0.2	X
Tellurium and compounds (as Te)....	13494-80-9	.....	0.1	
Tellurium hexafluoride (as Te).....	7783-80-4	0.02	0.2	
Temephos.....	3383-96-8			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
TEPP (Tetraethyl pyrophosphaate).....	107-49-3	.....	0.05	X
Terphenylis.....	26140-60-3	(C)1	(C)9	
1,1,1,2-Tetrachloro-2,2-difluoroethane.....	76-11-9	500	4170	
1,1,2,2-Tetrachloro-1,2-difluoroethane.....	76-12-0	500	4170	
1,1,2,2-Tetrachloroethane.....	79-34-5	5	35	X
Tetrachoroethylene; see Perchloroethylene				
Tetrachloromethane; see Carbon tetrachloride.				
Tetrachloronaphthalene.	1335-88-2	.....	2	X
Tetraethyl lead (as Pb)	78-00-2	.....	0.075	X
Tetrahydrofuran.....	109-99-9	200	590	
Tetramethyl lead, (as Pb).....	75-74-1	.....	0.075	X
Tetramethyl succinonitrile.....	3333-52-6	0.5	3	X
Tetranitromethane.....	509-14-8	1	8	
Tetryl (2,4,6-Trinitrophenylmethyl-nitramine).....	479-45-8	.....	1.5	X
Thallium, soluble compounds (as Tl)....	7440-28-0	.....	0.1	X
4,4'-Thiobis(6-tert, Butyl-m-cresol).....	96-69-5			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Thiram.....	137-26-8	.....	5	
Tin, inorganic compounds (except oxides) (as Sn).....	7440-31-5	.....	2	
Tin, organic compounds (as Sn).....	7440-31-5	.....	0.1	
Titanium dioxide.....	13463-67-7			
Total dust.....		.....	15	
Toluene.....	108-88-3		(2)	
Toluene-2,4-diisocyanate (TDI)..	584-84-9	(C)0.02	(C)0.14	
o-Toluidine.....	95-53-4	5	22	X
Toxaphene; see Chlorinated camphene.				
Tremolite; see Silicates.....				

Tributyl phosphate.....	126-73-8	.....	5	
1,1,1-Trichloroethane; see Methyl chloroform				
1,1,2-Trichloroethane..	79-00-5	10	45	X
Trichloroethylene.....	79-01-6		(2)	
Trichloromethane; see Chloroform				
Trichloronaphthalene...	1321-65-9	.....	5	X
1,2,3-Trichloropropane.	96-18-4	50	300	
1,1,2-Trichloro-1,2, 2-trifluoroethane....	76-13-1	1000	7600	
Triethylamine.....	121-44-8	25	100	
Trifluorobromomethane..	75-63-8	1000	6100	
2,4,6-Trinitrophenol; see Picric acid.....				
2,4,6-Trinitrophenyl- methyl nitramine; see Tetryl.....				
2,4,6-Trinitrotoluene (TNT).....	118-96-7	.....	1.5	X
Triorthocresyl phosphate.....	78-30-8	.....	0.1	
Triphenyl phosphate....	115-86-6	.....	3	
Turpentine.....	8006-64-2	100	560	
Uranium (as U).....	7440-61-1			
Soluble compounds....		.....	0.05	
Insoluble compounds..		.....	0.25	
Vanadium.....	1314-62-1			
Respirable dust (as V(2)O(5)).....		.....	(C)0.5	
Fume (as V(2)O(5))...		.....	(C)0.1	
Vegetable oil mist.....				
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Vinyl benzene; see Styrene.....				
Vinyl chloride; see 1910.1017.....	75-01-4			
Vinyl cyanide; see Acrylonitrile				
Vinyl toluene.....	25013-15-4	100	480	
Warfarin.....	81-81-2	.....	0.1	
Xylenes (o-, m-, p-isomers)..	1330-20-7	100	435	
Xylidine.....	1300-73-8	5	25	X
Yttrium.....	7440-65-5	.....	1	
Zinc chloride fume.....	7646-85-7	.....	1	
Zinc oxide fume.....	1314-13-2	.....	5	
Zinc oxide.....	1314-13-2			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zinc stearate.....	557-05-1			
Total dust.....		.....	15	
Respirable fraction..		.....	5	
Zirconium compounds (as Zr).....	7440-67-7	.....	5	

Footnote(1) The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.

Footnote(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

Footnote(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

Footnote(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.

Footnote(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 1910.1028 for specific circumstances.

Footnote(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

Footnote(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

Footnote(2) See Table Z-2.

Footnote(3) See Table Z-3

Footnote(4) Varies with compound.

[54 FR 36767, Sept. 5, 1989; 54 FR 41244, Oct. 6, 1989; 55 FR 3724, Feb. 5, 1990; 55 FR 12819, Apr 6, 1990; 55 FR 19259, May 9, 1990; 55 FR 46950, Nov. 8, 1990; 57 FR 29204, July 1, 1992; 57 FR 42388, Sept. 14, 1992; 58 FR 35340, June 30, 1993; 61 FR 56746, Nov. 4, 1996; 62 FR 42018, August 4, 1997]

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**Appendix VI
Regulations (Standards - 29 CFR)**

TABLE Z-2 - 1910.1000TABLEZ-2

- **Standard Number:** 1910.1000TABLEZ-2
- **Standard Title:** TABLE Z-2
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances

TABLE Z-2

Substance	8-hour time weighted average	Acceptable ceiling concentra- tion	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	
			Concen- tration	Maximum duration
Benzene(a) (Z37.40-1969).....	10 ppm.....	25 ppm.....	50 ppm...	10 minutes.
Beryllium and beryllium compounds (Z37.29-1970).....	2 ug/m(3)..	5 ug/m(3)..	25 ug/m(3)	30 minutes.
Cadmium fume(b) (Z37.5-1970).....	0.1 mg/m(3)	0.3 mg/m(3)	.....
Cadmium dust(b) (Z37.5-1970).....	0.2 mg/m(3)	0.6 mg/m(3)		
Carbon disulfide (Z37.3-1968).....	20 ppm....	30 ppm.....	100 ppm..	30 minutes.
Carbon tetrachloride (Z37.17-1967).....	10 ppm.....	25 ppm.....	200 ppm..	5 min. in any 4 hrs.
Chromic acid and chromates (Z37-7-1971).....	.....	1 mg/10 m(3)		
Ethylene dibromide (Z37.31-1970).....	20 ppm.....	30 ppm.....	50 ppm...	5 minutes.
Ethylene dichloride (Z37.21-1969).....	50 ppm.....	100 ppm....	200 ppm..	5 min. in any 3 hrs.
Fluoride as dust (Z37.28-1969).....	2.5 mg/m(3)	.....	.....
Formaldehyde: see 1910.1048.....	.....	.....	.....

Hydrogen fluoride (Z37.28-1969).....	3 ppm.....	.....	.....
Hydrogen sulfide (Z37.2-1966).....	.....	20 ppm.....	50 ppm...	10 mins. once only if no other meas. exp. occurs.
Mercury (Z37.8-1971).....	.....	1 mg/10m(3)	.....
Methylene chloride (Z37.18-1969).....	.....	.....	.....
Methylene Chloride: see 1910.1052.....				
Organo (alkyl) mercury (Z37.30-1969).....	0.01mg/m(3)	0.04 mg/m(3)	.....
Styrene (Z37.15-1969).....	100 ppm....	200 ppm....	600 ppm..	5 mins. in any 3 hrs.
Tetrachloroethylene (Z37.22-1967).....	100 ppm....	200 ppm....	300 ppm..	5 mins. in any 3 hrs.
Toluene (Z37.12-1967).....	200 ppm....	300 ppm....	500 ppm..	10 minutes
Trichloroethylene (Z37.19-1967).....	100 ppm....	200 ppm....	300 ppm..	5 mins. in any 2 hrs.

Footnote(a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard at 1910.1028.

Footnote(b) This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.

[62 FR 42018, August 4, 1997]

APPENDIX VII

APPENDIX VII

ODOR AS AN AID TO CHEMICAL SAFETY*

CHEMICAL	TLV (PPM)	AOT (PPM)
ACETONE	750	13
AMMONIA	25	5.2
ARSINE	0.05	0.5
CARBON MONOXIDE	50	100,000
CHLORINE	1	0.31
CHLOROFORM	10	85
P-DICHLOROBENZENE	75	0.18
ETHYL ALCOHOL	1000	84
ETHYL ETHER	400	8.9
HYDROGEN SULFIDE	10	0.008
METHYL ALCOHOL	200	100
METHYLENE CHLORIDE	100	250
NAPHTHALENE	10	0.084
OZONE	0.1	0.045
PHENOL	5	0.04
TOLUENE	100	2.9
VINYL CHLORIDE	5	3000
M-XYLENE	100	1.1

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APPENDIX VIII

Drexel University Laboratory Safety Self-inspection Checklist

Date : _____

Building : _____

Floor : _____

Room : _____

PI : _____

Inspector : _____

Please return via fax to Jonathan Chase at (215) 762 - 7899

Issue / Violation		A	U	NA	Description	Correction
Research Compliance						
R1	All Research Protocols Approved by Biosafety Committee/ULAR/IRB					
R2	Office of Research has been notified of deviations / revisions of Protocol					
Chemical Safety						
C1	All chemical containers are labeled properly & dated					
C2	Labels are present on lab doors and cabinets					
C3	Old labels have been removed from doors and cabinets					
C4	Chemical Inventory available					
C5	MSDS are bound and present, and staff are aware of the location					
C6	Chemicals are stored compatibly					
C7	Peroxide forming chemicals are dated upon receipt & disposed of properly					
C8	Corrosive liquids are stored below eye level					
C9	Explosion Proof cabinets are used to store flammable chemicals					
C10	Fumehoods are free of stored material					
C11	An eyewash is present within 25 feet of lab and is tested quarterly					
C12	Safety Shower is inspected quarterly, is not blocked, handles hang free					
C13	PPE are available and are being used properly					
C14	Staff is aware of locations of, or how to obtain, PPE					
C15	Compressed oxidizers & flammables are not stored together					
C16	No Eating, Drinking.... Policy is being followed					
C17	Chemical spill materials are available					
C18	Chemicals are being disposed of properly, labeled as "Hazardous Waste"					
Physical Safety						
P1	General Housekeeping - orderly, uncluttered w/ benches cleaned daily					
P2	First Aid kit available					
P3	Telephones labeled with emergency numbers					
P4	Compressed Gas Cylinders are capped and properly secured					
Biological Safety						
B1	Sharps containers are present and not overfilled					
B2	Biosafety Cabinets are currently certified, being used properly and decontaminated after use					
B3	Universal / Standard Precautions are being observed where applicable					
B4	No Sharps in Red Bags					
B5	No Sharps in regular trash					
B6	No Infectious waste in regular trash					
B7	Infectious waste container is labeled "Biohazard" or "Infectious Waste"					
Fire Safety						
F1	Staff is knowledgeable of R.A.C.E. and P.A.S.S.					
F2	Staff is aware of the locations of fire extinguishers and pull stations					

APPENDIX IX

APPENDIX IX

Drexel University

Eye Wash and Safety Shower Quarterly Inspection Check List

Building _____ Floor _____ Room No. _____

Ex. Jan '99 ok ok Jonathan M. Chase, MS

Month / Year	Eye Wash	Safety Shower	Name of Inspector

Please complete for each laboratory, post copy in lab and send copy to University Department of Safety and Health

APPENDIX X

Appendix X

Drexel University
University Department of Safety and Health

Phone (215) 895-5907
Fax (215) 895-5926

Chemical Pick-Up Request / Chain of Custody

Dept. _____
Location _____

Page _____ of _____

Floor _____
Phone _____

Room # _____

Chemical / Product Name	Hazard Classification	Container Type	Number Of Containers	Total Quantity

Released By

Print _____
Sign _____
Fax _____ Date _____

Transport to Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____

Received at Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____

Released from Temporary Storage By

Print _____
Sign _____
Fax _____ Date _____